Learning and Leading Collaboratively:
A Study of Intermediate Teachers Engaged in Project Based Learning in Three Elementary Schools

by

Matina Elizabeth Mosun

A thesis submitted in conformity with the requirements for the degree of Doctor of Education
Department of Leadership and Higher Adult Education
Ontario Institute for Studies in Education
University of Toronto

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Abstract
This qualitative study examines teacher learning during project based learning (PBL) in three elementary schools. This multiple case study involved an analysis of 10 participating teachers’ interview responses about how they learn to adapt their practice to meet their students’ needs and the beliefs these teachers hold about teaching and learning collaboratively, both from and with their students and from and with other teachers. The findings suggest that teachers who facilitate PBL engage in learning that takes place collaboratively and that skilled teachers who engage in PBL learn to direct their own learning. To support teachers in this area, schools should continue to provide learning opportunities with a focus on both student and teacher development.
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Chapter 1: Introduction

Researcher Background

In my experience as an elementary music teacher and primary division lead teacher, I have found that students enjoy learning activities that require movement. In recent years, cross-curricular programing that includes project work has gained popularity in elementary classrooms. Because I have found this programming to be helpful to my students, I have sought to incorporate more dynamic experiences involving collaboration in my teaching. These experiences have provided a more effective, engaging learning environment for my students, myself and other teachers.

My personal dedication to meeting the individual needs of students and my dissatisfaction with the lack of varied learning opportunities for some students fueled my interest in equitable, differentiated, collaborative learning experiences. I have sought to provide students with opportunities to demonstrate their understanding and abilities in ways that would have the most impact on their own individual learning, highlight their strengths, and support areas in which they are still growing.

During my M. Ed. studies completed in 2011, I examined the role of extension activities as they relate to children’s reading development. In a study involving Grade 1 struggling readers, I designed a shared reading session that incorporated vocabulary development, independent and group reading opportunities, and a dramatic element. Knowing that it is by incorporating a variety of teaching activities that teachers can build on the unique strengths of their students and encourage social collaboration (Adomat, 2010; Hoyt, 1992), my aim was to provide a reading group experience that incorporated ‘gesture’ as a shared communicative act (Tomasello, 2003),
to foster students’ reading development. As part of their regular shared reading lesson, participants were asked to respond to texts either through a gestural action or in a written form. For example, in response to a text about rain, a student might gesture rain drops falling with their fingers, or draw a picture of clouds and rain.

In the study, students who struggled with reading seemed to be more motivated to engage in reading when gestures were used in comparison with writing. Consistent with research by Einarsdottir and Wagner (2006), while gestures may not be necessary to understanding, the use of gestures in this study with struggling readers was found to increase engagement which may promote learning. The study also recognized the importance of the arts in learning experiences (Ministry of Education, 2009) and provided an example of how educators who are willing to incorporate multi-modal teaching approaches for learning are better equipped to further promote student engagement (Mosun, 2011). Knowing the importance of collaboration in engagement and the role it plays in learning, I now seek to study how teachers learn through collaborating with their students and colleagues within the context of project based learning (PBL).

**Educational Context**

There is an increasing urgency for educators to address both the academic and social-emotional needs of students, with a greater focus placed on teaching and learning that is student-centred. Greater importance is being placed on the development of skills (Scardamalia & Bereiter, 2006) such as critical thinking and problem solving that are essential for the future (Trilling & Fadel, 2009). These skills are often referred to as twenty-first century skills. A focus on skills necessary for collaboration, such as communication, cooperation, creativity, and persistence, has also been evident in this growing area of research in education (Tough, 2012; Trilling & Fadel, 2009), with research suggesting that many students are graduating without
these skills which is compromising their ability to complete post-secondary education programs and maintain employment (Darling-Hammond, 2006; Tough, 2012; Wagner, 2008). The Organization for Economic Co-Operation and Development (OECD) has stressed that, in order to prepare students for the future, schools must adopt new teaching practices (2010) that support the development of these skills to prepare students for future employment.

Adapting teaching to meet the needs of every student in a variety of ways is also identified as part of a series of recommendations outlined in the Ontario Ministry of Education’s document, Growing Success (2011). Teachers need to encourage students to develop the essential skills to communicate and negotiate (Zhou, 2012). In response to these recommendations, many teachers seek ways to collaborate with students in order to provide differentiated learning experiences and to foster engagement, including engaging with students in collaborative experiences and projects (Barron & Darling-Hammond, 2008; Growing Success, 2010) with a focus on the co-construction of learning (Webster-Wright, 2009).

Knowing that experience shapes teachers’ understanding and that this ultimately informs their professional practice (Timperley, 2007), investigating how teachers adapt to new experiences is important for understanding the learning of teachers. As teacher learning occurs throughout a teacher’s professional life (Day, 1999), teacher learning must be examined within multiple contexts and must encompass teachers both as individual learners, and as participants who learn with others (Borko, 2004; Wyse, Davis, Jones, & Rogers, 2015), if we are to effectively support teachers as they learn to meet the evolving needs of their students.

**Project Based Learning**

Project Based Learning (PBL) is a method where students and teachers work collaboratively toward the completion of a product, event, or presentation (Darling-Hammond et
While not new, PBL has gained in popularity as a learning method that has the potential to engage learners in a variety of ways. Because PBL requires a shift from a traditional teacher-centred approach to a student-centred approach (Katz & Chard, 2000), teachers undertaking PBL often attend workshops and collaborative inquiry sessions that assist them in the facilitation of PBL with their students.

While some research has questioned the effectiveness of PBL (Kirschner, Sweller, & Clark, 2006), many studies have shown its positive effects on student learning (Boaler, 1997, 1998; Duke, Halvorsen, Strachan, Kim, & Konstantopoulos, 2017; Geier, et al., 2008; Meyer, Turner, & Spencer, 1997; Thomas, 2000; Wirkala & Kuhn, 2011). Some research has focused on the professional development of teachers engaged in PBL teaching (Borko & Livingston, 1989; Krajcik, Blumenfeld, Marx, Bass, & Fredricks, 1998; Rosenfeld & Rosenfeld, 1998) or of pre-service teachers preparing to use PBL in mathematics or science classrooms (Abell & Bryan, 1997; Cooney, 2001; Zhou, 2012). Some studies have focused on the use of PBL within post-secondary institutions (Helle, Tynjala, & Olkinuora, 2006) and in undergraduate courses (Gulbahar & Tinmaz, 2006). A few studies have focused on specific aspects of PBL, such as the development of students’ skills in collaboration (Kuhn, 2015) and argumentation (Kuhn, Zillmer, Crowell, & Zavala, 2013), and the importance of scaffolding students’ learning to support the development of reasoning skills (Hmelo-Silver, 2007).

While some research on PBL has been conducted with elementary school-level students (Bell, 2010; Li, 2012), little research has focused on elementary school teachers, particularly those who teach multiple subjects. Given its student-centred approach, facilitating PBL can be difficult for some teachers (Darling-Hammond et al., 2008; Levy & Shriki, 2008; Zhou, 2012) and teachers often face a steep learning curve (Thomas, 2000). Additionally, because teachers’
beliefs affect how they implement new programs and scaffold learning (Fullan, 2007; Grant, 2011; Krajcik et al., 1998), research on the perspectives of teachers engaged in PBL is required to gain a better understanding of how teachers learn as they facilitate PBL.

**Research Question**

While much research has focused on the benefits of PBL, little research has focused on the perspectives of teachers who are facilitating PBL, particularly at the elementary-school level. This study, therefore, will seek to answer the following research question within an elementary-school context:

What and how are teachers learning in the context of PBL, both from and with other teachers and from and with their students?

**Definitions**

*Collaboration:* This study uses Wenger’s (2000) definition of collaboration which he described as, an activity of “groups of people who share a concern or passion for something they do and learn how to do it better as they interact regularly” (Wenger, 2016, para. 5).

*Project Based Learning (PBL):* For the purpose of this study, PBL is defined as “a procedural method where students and teachers work collaboratively toward the completion of a product, event, or presentation” (Darling-Hammond et al., 2008).

**Significance of the Study**

This study explores teacher collaboration and learning both from and with students and other teachers within the context of project based learning and builds on previous research that demonstrates the need for schools to provide activities that are engaging for both students and teachers. In addition to adding to our understanding of what and how teachers learn through
collaboration, this study adds to our understanding of how teachers learn to facilitate collaborative experiences throughout the process of PBL. The findings have implications for school leaders seeking to support both student and teacher development.

**Thesis Outline**

This thesis is organized into five chapters, the first of which has provided information on the researcher’s background and the motivation for this study. Chapter 2 discusses theories relevant to this research study. Chapter 3 outlines the methodology of the study and provides a clear description of the methods used. Chapter 4 provides a discussion and analysis of the interview data. Chapter 5 provides a concluding discussion, including study implications, and provides recommendations for further research.
Chapter 2: Review of the Literature

This chapter begins with a discussion of socio-constructivist theory. Following this, research on the role of communities of practice in teachers’ learning is reviewed. Next, research on the significance of collaboration and the ways in which teachers build professional capital and leadership through collaboration are examined. Finally, a discussion of the benefits of project based learning and the influence and implications of these learning experiences on classroom teaching and learning is presented.

Socio-constructivist Theory

Socio-constructivist theory holds that social interaction is the primary means by which students arrive at new understanding (Vygotsky, 1978). Vygotsky acknowledged the importance of social interaction as a means of acquiring new understanding and recognized that when students learn from a more competent other such as a peer or teacher, they are engaged in an important process of learning. Vygotsky referred to this as the Zone of Proximal Development (ZPD). It can also be described as referring to the distance between what a student can do with and without assistance (Vygotsky, 1978).

From a socio-constructivist perspective, learners learn in relation to a more competent other, such as a parent or teacher, or more experienced peer, through social interaction. The process of supporting tasks that are difficult for a learner to achieve independently is described as scaffolding (Wood, Bruner, & Ross, 1976). Scaffolding can occur among students, between students and teachers, and also among teachers.
Scaffolding of concepts requires skillful attention from teachers based on the teacher’s familiarity with Developmentally Appropriate Practice (DAP) (Bredekamp & Copple, 1997). DAP suggests that teachers extend students’ thinking and learning through asking developmentally appropriate questions, adding complexity to tasks and interacting in both student- and teacher-led experiences that are relevant to the student’s development (Bredekamp & Copple, 1997, p. 128). Through these experiences, the responsibility for the learning shifts to the learners, and the social interaction that occurs promotes learning and understanding (Vygotsky, 1978). In this view, teachers both stimulate and support students’ learning in order to assist students in acquiring new skills.

Vygotsky’s socio-constructivist theory is also helpful in understanding teachers’ learning. According to Richardson and Placier (2001), teachers who work collaboratively both learn from and support the learning of others. From a normative re-educative perspective, teacher learning is sociocultural, where teachers’ professional learning is based on their personal growth as well as their collaboration within the organization in which they work and learn (Richardson & Placier, 2001).

Another theory related to Vygotsky’s work is that of Bruner (1996), who focused on the agency of the learner, with emphasis on the teacher as a co-learner and the meta-cognition involved with learning at all stages, whether a teacher or a student. In this view, knowledge and new understanding are constructed by the learner through social experiences. This conceptualization of professional learning is also echoed in the work of Webster-Wright (2009), who emphasises the importance of the teacher as a “knowledge-possessing” provider rather than a “knowledge-deficient” professional (p. 713). Her reconceptualization of professional
development as professional learning makes clear the need for a theoretical framework for understanding the complexity of teacher learning (Webster-Wright, 2009).

**Collective-Efficacy**

Viewed through a socio-cognitive lens, self-efficacy motivates individuals to collectively shape events and create experiences (Bandura, 2000). From this perspective, goals are achieved through interdependent efforts motivated by beliefs of self-efficacy (Bandura, 1997). Whether it is achieved individually or as a group, perceived efficacy is vital to producing desired results (Bandura, 2000). According to Bandura (2000), perceived collective-efficacy “is people acting co-ordinatively on a shared belief” (p. 76), which motivates individuals’ behaviour collectively to set and achieve goals. Collective-efficacy provides another perspective on learning as a social practice and acknowledges the importance of both individual and collective beliefs applicable to dynamic environments such as schools where individuals operate both independently and collaboratively.

**Communities of Practice**

Social learning has also been the focus of Wenger (2000), whose research has explored the relationship between social competence and personal experience as part of social learning systems. Individuals who collaborate to produce and implement projects are engaging in what Wenger refers to as situated learning (Lave & Wenger, 1991), in which, through collaborative experience, individuals become part of a community of practice (CoP). A CoP involves a group of people who share an expertise and learn from each other through interactions (Wenger, 2000). Wenger describes participation in a CoP as essential to learning (Wenger, 2000), with each group member’s individual competence contributing to the individual’s learning as well as the growth and success of the group.
Wenger lists three elements that contribute to competence within a CoP: members have a joint enterprise (collective understanding), mutuality (mutual engagement), and a shared repertoire (which includes language, skills, and styles) (Wenger, 2000). Wenger emphasizes that community development within a CoP requires many types of leadership. While members of CoPs learn to work internally within an organization, they must also develop the flexibility to operate outside of their organization. Wenger’s notion of a CoP is helpful in explaining the dynamic role of teachers as both learners in and facilitators of collaborative experiences.

**Professional Capital**

Throughout their professional career, teachers engage in ongoing learning. The skills and knowledge that teachers acquire through working collaboratively with other teachers and with students contribute to their professional practice and the decisions they make. Whether it is learning along with their students or leading a class, teachers’ personal experience contributes to their professional practice. Included in teachers’ learning is the development of leadership skills, which is also attributed to group development (Fullan, 2014). Highlighting the importance of learning alongside teachers, this type of leading to learn is described within the framework of “professional capital” – that is, when groups of teachers work together in a school, student learning increases (Fullan, 2014).

According to Fullan (2014), a school’s professional capital is influenced by the interaction of three components: human capital (teachers’ talents), social capital (teachers’ interactions), and decisional capital (teachers’ decision-making expertise). Strong social capital within a group enables the group to accomplish much more than a group with weak social capital (Fullan, 2014), making experience that incorporates collaboration, interpersonal relations, and individual expertise necessary for teaching and learning. Through collaboration, teachers practice
learning to cooperate, learn to make decisions, and learn to trust their professional judgement. Because teachers are not directly taught these skills prior to teaching, group involvement and the learning that is gained through working collaboratively is an important aspect of teacher development influencing student achievement.

**Teachers’ Learning Processes**

Based on a synthesis of 97 studies of professional development in which the students of the participating teachers had improved outcomes, Timperley (2008) concluded that: teachers’ practice strongly influences student learning; teachers’ beliefs influence what they teach and how they understand learning; schools must be set up to support how teachers learn; and teachers learn through experiences that are shaped by their understanding. Teacher learning has also been described as reliant on the interdependence of individuals through their social interaction, support, and collaboration – that is, it is through collaborative experiences that teachers grow professionally (Timperley, 2007).

Although the complexity of teaching makes it difficult to identify precisely when teachers develop new understandings and skills, Timperley (2007) describes teacher learning as a series of experiences, which she identifies as: cueing and retrieving prior knowledge (what teachers already believe); becoming aware of new information/skills and integrating them into their existing beliefs system (what they need to add to what they already believe); and creating dissonance with their current beliefs (resolving or rejecting new learning into their current beliefs). In this way, teachers engage in a process of learning which involves a struggle as to whether or not to accept or reject new understanding. This decision-making process contributes to how teachers support the learning of their students and collaborate with their colleagues. This process describes how teacher learning is inextricably linked to teaching practice and how
teachers’ beliefs and values play an important role in whether or not teachers adapt their practice over time.

**What Teachers Believe and Value**

Decisions teachers make in teaching are rooted in their beliefs about effective learning (Rosenfeld & Rosenfeld, 2008) and the value they place on activities and experiences (Kuhn, 2003; Opfer, Pedder, & Lavicza, 2011). If these beliefs are based on the teachers’ personal learning needs, students with different learning needs than the teachers may be at a disadvantage (Sternberg, 1997). Because knowledge and beliefs about teaching can impact the design and implementation of PBL (Krajcik, Blumenfeld, Marx & Soloway, 1994), there is a need to research teachers’ beliefs to better understand teachers’ practice (Lynch, 2010).

In working collaboratively with their students, through their encouragement and enthusiasm, teachers model authentic learning engagement and exhibit positive values (Kuhn, Demberger, & Khait, 2016). According to Kuhn (2003), when teachers guide students through activities they value, they model their own commitment to activities and their belief in the worth of those activities. Opfer et al. (2011) describe what teachers value as representative of “not just what a teacher thinks to be true about teaching and learning, but what they would give high priority to in their own practice” (p. 444). However, few teachers seem to be supported in successfully integrating what they value into their practice (Pedder & Opfer, 2013).

While research on student learning suggests that values play a role in student engagement (Eccles & Wigfield, 2002), there is little research on values related to teacher learning (Opfer et al., 2011; Pedder & Opfer, 2013). In a study involving survey responses from more than a thousand teachers in England, Opfer et al. (2011) found that teachers’ professional learning occurs individually as well as with others. In their view, teacher learning is influenced by
teachers’ “individual beliefs, practices, and experiential context” (p. 451), which further emphasizes that teachers’ professional learning is both related and interrelated (Huberman, 1995).

Pedder and Opfer (2013) have also described teachers who are effective professional learners as ‘engaged learners’ who “possess a very flexible and broad repertoire of professional learning practices in line with their values” (p. 17). However, they posit that few teachers receive the support they require to carry out teaching that is line with their values as an ‘engaged learner’ (Pedder & Opfer, 2013), which further highlights the importance of providing teachers who work collaboratively with the support necessary to provide quality learning for their students. However, Kuhn et al. (2016) posit that the positive values teachers exhibit through collaborative experiences can be observed beyond the classroom, making teachers’ values important to teachers’ own professional development as well as to teachers’ classroom practice.

Adaptive Learning Experts

Hattie (2012) describes teachers who know a multitude of ways of learning and teaching so that they are able to model a variety of ways of learning themselves as “adaptive learning experts” (p. 185). Adaptive teachers have been described as those who have a vision, regularly informally assess their students and reflect on their practice, and know their students well (Vaughn, Parsons, Gallagher, & Brannen, 2016). However, because teacher practice is often deeply rooted in teachers’ individual beliefs and experiences (Borko & Putnam, 1996), becoming an ‘adaptive learning expert’ can be a steep learning curve for teachers. Working collaboratively with students presents an opportunity for teachers to learn alongside their students.
**Teacher Leadership**

Effective educational leadership has been described as reliant on the involvement of many people and their efforts to master paradox and challenge (Cronin & Genovese, 2012). Teachers regularly face paradoxes when working collaboratively, such as when choosing whether or not to promote fairness or rigidity (Stone, 2002, p. 291). Cronin and Genovese (2012) suggest that teachers’ experiences with paradoxical situations contribute to their knowing when to lead and knowing when to follow.

In addition to gaining an understanding of balancing paradox, teachers also learn to understand the politics of the school and their effect on the teaching practices within it through collaboration. Lasswell (1936) described politics in education as “who gets what, when and how” (cited in Ryan, 2010, p. 359). In schools, politics exist on multiple levels. Ryan (2010) stresses the importance of political understanding in maintaining balance in leadership and posits that those who navigate well through politics are more likely to succeed than those who do not. According to Ryan (2010), those who understand the political environment of an organization well enough to make meaning from their colleagues’ actions, words, and gestures are ‘politically astute’ (p. 360). Understanding the politics of education can serve as an important resource for navigating the relationships that exist within schools.

Collaborative experiences provide an opportunity to take advantage of individuals’ strengths, which promotes interdependence not just within a group, but also across an organization and may lead to an increase in self-determination and improved experiences (Leithwood, Louis, Anderson, & Wahlstrom, 2004) as well as improved optimism and increased engagement (Bandura, 2000; Fullan, 2014; Mascall, Leithwood, Strauss, & Sachs, 2009).
In learning from their experiences with other teachers through collaboration, teachers are better-equipped to operate as leaders and to make informed decisions about their work with other teachers as well as with their students. Kuhn et al., (2016) describe learning through collaborative experiences as a process in which learners are “taking ownership of knowledge” (p. 144). According to Kuhn et al. (2016), when one recognizes a purpose for new knowledge, new knowledge becomes valued, and when new knowledge is used, new knowledge becomes owned by the learner.

Through their experiences working collaboratively, teachers also learn to be mindful of social acumen and employ creative communicative skills based on context, such as using multiple modes of communication to facilitate conversations (Ryan, 2010). Buchanan and Badham (1999) refer to those who engage in this creative facilitation as ‘bricoleurs’, which has been described as those who assemble and utilize these diverse skills as resources in order to accomplish a goal (Ryan, 2010). Considering the complexity of teaching practice, understanding the political environment and becoming a ‘bricoleur’ is an important aspect of teacher learning. Acquiring these skills not only assists teachers as they navigate as leaders in their schools, they also learn the skills necessary to help their students develop the skills they need to learn in a collaborative environment.

The benefits of collaboration in education are numerous (Boaler, 1997; Chamberlin-Quinlisk, 2010; Johnson & Johnson, 1998; Kagan, 1994; Kuhn, 2015; Krajcik, Czerniak, & Berger, 1999; Slavin, 1996). Through collaboration, teachers have the potential to increase leadership development experiences for their students and also for other teachers (Leithwood et al., 2004, Timperley, 2007). However, collaborative experiences that help cultivate learning skill development must be facilitated by skilled teaching that takes place within an equally supportive
social framework in which the students are expected to thrive (Vygotsky, 1978). Teachers play an important role in the quality of learning that takes place through collaborative experiences (Hmelo-Silver, 2007; Kuhn et al., 2013).

The quality of collaborative experiences also plays a role in teachers’ motivation to teach and their interest in continuing to learn. Drawing on a meta-analysis of over 600 educational studies, Hattie (2009) suggests that “learning is the most powerful incentive to stay in teaching” (Hattie, 2012, p. 174). Ongoing learning plays a role in how teachers make decisions and is dependent on a broad range of factors which may include perceived support, experience, and personal beliefs about their own practice, all of which are affected by the support of school leaders so that teachers can influence their students in positive ways (Hattie, 2012).

Cain (2012) refers to collaboration in schools as ‘group think’ in which students and teachers are expected to work together. Cain explains that students and teachers have shifted into a role of a ‘committee member,’ with teachers now encouraged to focus their attention on ensuring all students are included, that learning experiences are equitable, and that students are provided a variety of opportunities to express their understanding and demonstrate their learning. In addition to meeting the social-emotional needs of students, teachers have moved from the role of classroom instructor to that of a learning facilitator (Rodrigues, 2005). Teachers who work collaboratively with their students can also be referred to as “coaches” who work as “facilitators of accountable talk” (Kuhn et al., 2016, p. 146) and develop ways to motivate their students to learn. Through collaborative experiences, teachers help students to develop their learning skills (Barron & Darling-Hammond, 2008) and teachers also learn new ways to teach (Hattie, 2009).
Cooperative Learning

As discussed earlier, research on learning among teachers and students emphasizes the importance of collaboration. Wenger (2000) has described teachers who collaborate as “groups of people who share a concern or passion for something they do and learn how to do it better as they interact regularly” (Wenger, 2016, para. 5). When a group divides tasks to accomplish shared learning goals they are engaging in cooperative learning (CL) (Johnson & Johnson, 1998). CL is defined by Baker and Clark (2010) as “learning that takes place in a stable, formal group of two or more students who work together and share the workload equitably as they progress toward assessed outcomes.” (p. 258). Johnson and Johnson (2002) outlined five conditions for successful cooperative learning: positive interdependence, face-to-face interaction, individual accountability, use of relevant interpersonal and small group skills, and frequent and regular group processing.

Benefits of cooperative learning

Research suggests that CL promotes increased intercultural understanding (Slavin, 1984) and improved interpersonal skills (Johnson & Johnson, 1998). Feichtner and Davis (1991) view CL as a learning experience that is essential for participating in a democratic society (Kagan, 1994). Sharan and Shaulov (1990) posit that students are more productive and learn more when they work cooperatively in groups. CL opportunities have also been shown to foster productivity and cooperation, more so than activities in whole-class settings (Gillies, 2007). Gillis and Boyle (2011) also suggest that “a positive benefit of cooperative learning” is that it provides “a strategy for involving those students who usually will not participate” (p. 73). Even for introverted learners, CL can work well in online formats, especially when the group is large (Cain, 2012).
Research also suggests that CL promotes self-awareness (Ernsting & Kotler, 2010) and can alleviate and prevent many social problems of children, adolescents, and young adults (Johnson & Johnson, 2000). CL experiences also remind students that the developmental process of learning includes mistakes, questions, and flexibility (Chamberlin-Quinlisk, 2010).

CL includes both informal and formal methods of classroom teaching (Johnson, Johnson, & Stanne, 2000). Included in the formal methods of CL is Project Based Learning (PBL) which can be described as a motivational tool that can engage students in learning both collectively and individually (Johnson & Johnson, 2002) and can similarly motivate teachers (Marx, Blumenfeld, Krajcik, & Soloway, 1997).

**Project Based Learning**

There are many definitions of PBL in the educational field. Clark (2006) has defined PBL as in-depth investigations where students engage in the development of investigative activities resulting in a product or performance. Typically, students work collaboratively with peers and teachers over a significant amount of time toward the completion of complex tasks that result in a product, event, or presentation (Darling-Hammond et al., 2008). PBL requires a collaborative, student-centred approach where teachers and students work together to plan and learn (Mitchell, Foulger, Wetzel, & Rathkey, 2009).

According to Thomas (2000), there are five key components for effective PBL: curriculum-focused; inquiry-driven; investigative and knowledge-building; student-driven; and real-world focused (as cited in Darling-Hammond et al., 2008). The goals of PBL go beyond the development of content knowledge by enabling students to transfer their learning to new kinds of situations and problems and to apply this knowledge appropriately to performance situations (Darling-Hammond et al., 2008).
Helle, Tynjala, and Olkinuora (2006) also describe PBL as student-focused, but with the added features of artefact creation and a greater focus on multiple forms of representation. Helle, Tynjala, and Olkinuora (2006) identify six main features of PBL relevant to cognitive psychology: problem orientation; constructing a concrete artefact; learner control of the learning process; contextualisation; multiple forms of representation; and intrinsic motivation. The first of these features rests on the idea that the activities in PBL are based on a problem or question. The second places emphasis on the construction process of the project and the development of a plan. Contextualisation of learning refers to the learning environment and engagement in a CoP (Wenger, 1998) formed through CL. Projects are also often represented through an interdisciplinary approach and through varying forms.

Blumenfeld et al. (1991) identify just two main features of PBL which will be used as a definition of PBL for the purpose of this study: 1) the presence of a problem or question that fuels student activities which lead to the development of an artefact and 2) a project that culminates in a final product that addresses the original question.

**Benefits of project based learning**

PBL engages students in collaborative, complex activities and an exploratory process of inquiry (Krajcik et al., 1999). Katz (1994) found that students demonstrated habits of mind such as curiosity, reflection, and empathy through PBL in Reggio-Emilia schools in Italy where teachers often work with small groups on projects (Mitchell et al., 2009). Other positive effects of PBL on student development include an increased sense of ownership and potential for learning and an increase in self-esteem (Chard, 2001). Ackers (2012) found that PBL has been effective in IB programs in China for students’ conceptual understanding. Research involving IB schools in Spain and New Zealand indicate that the PBL structure is used by IB students to solve
problems and is also used as an effective approach for students’ application of curricular understanding (Swartz & McGuinness, 2014).

Some research suggests that students develop higher-level thinking skills such as problem solving and self-regulation through PBL experiences (Brown & Campione, 1996). Research on the PBL approach suggests that students who engage in this approach benefit from gains that are equivalent or superior to the gains of students who engage in traditional forms of instruction (Thomas, 2000). Students who engage in PBL develop the essential skills to transfer and apply conceptual ideas across a variety of learning situations (Brown & Campione, 1996; Hmelo-Silver, 2006; Kuhn, 2015; Scardamalia & Bereiter, 1991).

Students engaged in PBL have also shown gains in critical thinking, an increase in confidence in their learning, and an increase in achievement on standardized test scores (Boaler, 1997; Darling-Hammond et al., 2008). Tan (2009) posits that through PBL experiences students may achieve skills related to creativity such as problem solving, communication, self-directed learning, and leadership. Because PBL engages students in open-ended projects, students involved tend to also engage in more exploration, discussion, and thought which contributes to a more flexible and useful development of knowledge among those students (Boaler, 1997, p. 63). PBL also provides students with an opportunity to struggle with problems, to develop an argument as part of a solution to a problem, and to listen to other points of view (Kuhn, 2015).

**Project based learning in the classroom**

Increases in motivation and a positive attitude toward learning, as well as improved work habits, critical thinking skills, and problem-solving abilities have been reported in research on PBL by Peck, Peck, Sentz, and Zaza (1998). Interestingly, struggling students within traditional
school settings have been found to excel when provided with the opportunity to engage in PBL experiences that match their interests (Boaler, 1997; Rosenfeld & Rosenfeld, 1998).

Research also shows that PBL helps students learn how to define problems (Gallagher, Stepien, & Rosenthal, 1992) and develop a greater motivation in planning projects (Moore et al., 1996). Kuhn (2015) examined PBL with a particular focus on argumentation. Her research on collaborative cognition suggests that collaborative discourse in PBL provides opportunities to listen and respond to ideas. This interaction and argumentation that occurs between individuals during intellectual collaboration in PBL aids in the development of important reasoning skills (Kuhn et al., 2014). As “intellectual collaboration does not come naturally” (Kuhn et al., 2014, p. 51), it must be taught as a skill that is best learned through practice (Ladd et al., 2013; Kuhn, 2015). In providing the opportunity for students to argue a point during collaborative work, teachers are providing a foundation from which essential skills, such as reasoning, can be further developed; however, how teachers foster this learning among their students is not clearly defined.

As a collaborative approach to learning and teaching, PBL requires teachers to play a supportive role in the development of each student’s project focus (Hmelo-Silver, 2006). A range of skills are required of teachers to help guide, support, and challenge students throughout their learning process to project completion. Reaching this goal requires teachers to demonstrate flexibility and an openness to change in order to meet each student’s needs. This task is dependent on a broad range of factors that include teachers’ beliefs about teaching practice.

Research suggests that many teachers are resistant to implementing project based teaching methods (Borko & Putnam, 1996). To help teachers become comfortable with PBL and to maintain a high standard of teaching practice in PBL, the International Baccalaureate (IB) and
The Buck Institute for Education (BIE) provide workshops and conferences for teachers. BIE has expressed concern about quality variation among teachers in PBL design and classroom practice. In response to this, BIE provides “gold standard” PD to help teachers learn how to develop, assess, and improve their PBL practice (Larmer, Mergendoller, & Boss, 2015).

**Conceptual Framework**

**Background**

Teacher learning has been described as reliant on the interdependence of individuals through their social interaction, support, and collaboration – that is, it is through collaborative experiences that teachers grow professionally (Timperley, 2007). Opfer, Pedder and Lavicza (2011) describe teachers’ professional learning as occurring individually as well as with others. In their view, teacher learning is influenced by teachers’ “individual beliefs, practices, and experiential context” (p. 451) which further emphasizes that teachers’ professional learning is both related and interrelated (Huberman, 1995).

Ongoing learning by teachers is dependent on a broad range of factors which may include perceived support, experience, and personal beliefs about their own practice (Kuhn, 2015; Lynch, 2010; Timperley, 2007), all of which is affected by the support of school leaders so that teachers can affect their students in positive ways (Hattie, 2012). These relationships are depicted in Figure 1.
Figure 1. Conceptual framework.

Figure 1 illustrates a hypothetical scenario of four teachers and four students whose collaborative learning is indicated by arrows among students, among teachers, and between students and their teachers. Bolded arrows represent areas of focus in this particular study while shaded arrows represent areas that are not examined in this study. Similarly, because students are not the main focus of this study, they are also shaded. Also, while not the focus of this study, the long arrows between students represent collaborative learning opportunities that may occur between students.
Teachers’ individual knowledge and skills, beliefs and attitudes, and classroom practice are shown within the circle that represents each teacher. These constructs are possessed by each individual teacher and extend to learning beyond the context of the classroom. The adoption of new knowledge and skills for classroom practice is moderated by the personal beliefs and attitudes of each teacher. Similarly, the adoption of new classroom practice as knowledge and skills is also moderated by each teacher’s beliefs and attitudes. This model represents the personal struggle that teachers engage in when adopting new learning and also the notion that new knowledge becomes owned by the teacher when it is used.

At the centre of the framework is school support. This is depicted as stretching among and between students and teachers. For students, school support may include daily schedules, faculty support, student support, or physical environments. In addition to these, for teachers, school support may also include professional development and technology. While not imperative for collaboration among and between students and teachers, more generally, school support represents an environment conducive to collaborative learning opportunities. While administrative support was not a major focus of this study, teachers’ perceived school support will be explored as it relates to teachers’ facilitation of PBL in their respective schools.

**Summary**

This study on PBL is approached from a socio-constructivist perspective. Collective efficacy, teachers’ learning processes, and communities of practice are relevant to this research. Teachers’ collaboration with their students and with other teachers was discussed as well as what teachers believe and value and the role beliefs and values play in teacher practice. Collaboration and leadership was also discussed as they relate to distributed leadership in schools. Cooperative learning and PBL were discussed as they relate to student and teacher learning. The conceptual
framework illustrates the focus of this research study. The methods used in this study are discussed in the following chapter.
Chapter 3: Methodology

Qualitative Research

This study sought to answer the following research question: what and how are teachers learning within the context of PBL, both from and with other teachers and from and with their students?

Qualitative research is an effective method to employ when attempting to understand individuals’ lived experience and how they develop the perspectives they hold (Bogdan & Biklen, 2006). In this multiple case study, semi-structured interviews, observations, and field notes were used to better understand the perspectives of the teachers engaged in PBL in their subject area and how they learn as they collaborate throughout the process. Each semi-structured interview was audio-recorded and transcribed by the researcher. Observations and anecdotal notes regarding classroom layout, resources, materials, and classroom interactions were written down to provide contextual details.

Overview of Participants

Participating schools

The researcher approached five schools that used PBL in the classroom. The distance between the sites was significant, with each site completely separate and no relationship between them. After a preliminary interview, one school declined to participate due to research fatigue and another school declined to participate due to a school evaluation happening at the same time. Ultimately, three small co-educational independent schools agreed to participate in the study: one Kindergarten to Grade 8 school (School A), and two Pre-Kindergarten to Grade 12 schools (School B and School C). Two of the schools were located in an urban centre in southeastern
Ontario, Canada, and one school was located in a rural location about 100 km away from the other schools. The schools serve students from families of middle- to high-socio-economic backgrounds of varying ethnicities, cultures, and languages and follow the Ontario Ministry of Education’s curriculum guidelines, *The Ontario Curriculum* (Ontario Ministry of Education, 2009).

**School A**

In operation for over 25 years, the school has a goal of remaining innovative with a focus on student-centred learning. The school aims to provide a teaching and learning environment that incorporates inquiry and project based learning. Overall, the curricular program extends beyond the expectations of the Ontario curriculum with additional student-initiated learning, hands-on experience, and experiential learning opportunities. The school serves 300 students from Kindergarten to Grade 8. As a whole, the school supported PBL across grades and subjects. At the time of the study, PBL was gaining in popularity among teachers, with some teachers working collaboratively with teachers in other grades. The school had provided ongoing professional development related to PBL and was actively engaged in the early stages of implementation school-wide.

Three Grade 7 teachers were approached by the researcher after permission was given by the school principal. Each of the three Grade 7 teachers were willing to participate in a short interview with the researcher: A mathematics teacher who had been teaching for 10 years, a French teacher who taught Grades 6, 7, and 8 and had been teaching for over 15 years, and a geography teacher who had been teaching for over 20 years. Each teacher taught the school’s two Grade 7 classes consisting of 23 students each (13 boys and 10 girls in each class) of varying academic levels and interests.
School B

In operation for over 100 years, School B has more than 1000 students enrolled from Kindergarten to Grade 12, with approximately 20 students in each class. The school offers Advanced Placement (AP) courses and an international student program. The school’s stated goal is to provide each student with a unique learning experience that is rooted in student-driven inquiry. Some teachers at the school had been using PBL in their classrooms for several years. Support for PBL has been growing at an administrative level. At the time of the study, the school was actively engaged in implementing PBL across multiple grades and subjects and had recently committed to ongoing professional development for teachers in PBL with a plan for each lead teacher to have completed the PBL professional development courses over the next two years.

The researcher approached a Grade 5 and 6 science teacher who agreed to participate in the study. After meeting with the school principal and Head of Academics, it was discussed that more teachers might be interested in the study. The Grade 5 and 6 science teacher assisted in connecting the researcher to more teachers at the school. A Grade 7 and 8 science teacher, a Grade 7 English teacher, a Grade 6 and 7 English teacher, and a Grade 7 and 8 mathematics teacher were approached by the researcher and agreed to a class observation and interview. Each teacher’s class consisted of 22 students (10 boys and 12 girls in each class) of varying academic levels and interests. While some of the teachers taught the same students, some teachers teaching the same grade taught a different section of the class and therefore worked with different students.

School C

For over 50 years School C has provided a coeducational bilingual program with a focus on an international perspective. The school provides programming in both English and French to
more than 1300 students age 2 to Grade 12. Curricular programming is based on the Ontario Curriculum as well as the International Baccalaureate (IB). Overall, the school teaches the Ontario Curriculum a grade ahead. Students engage in projects that reflect their personal interests and which are often based on an overarching theme. At the time of the study, PBL was well-established at School C, with teachers having used PBL in their classrooms for 8 years. After a phone call to the school principal explaining the scope of the study, the researcher was connected with a Grade 5 French and math teacher, and a Grade 5 English teacher. Both teachers taught the school’s Grade 5 class consisting of 23 students (8 boys and 17 girls).

**Participating teachers**

The selection of teacher participants was based on the following criteria: teaching experience not less than three years and at least one year of experience facilitating PBL in their classroom. Teachers were recommended by the administrator as teachers who were facilitating project based learning, at different stages of implementation and facilitation, and different levels of comfort with project based learning. In Schools A and B, the researcher contacted teachers directly after a preliminary discussion with administration. At School C, the researcher contacted the school principal directly. Once the researcher explained the study to the principal, the researcher was then connected to the teacher participants.

The researcher explained to the teachers in each school the purpose of the study. Overall, ten teachers agreed to participate in the study. The researcher’s intentions were made clear to participants through the information letters approved by university ethics. Letters requesting participation in the study were prepared for the principal (see Appendix A) and the teacher participants (see Appendix B). Once approved by University of Toronto Office of Research Ethics, the letters were distributed to participants. The researcher explained to the classroom
teachers that she would like to ask some questions about PBL occurring in their respective subject areas in order to better understand the teacher’s role in the PBL process and to understand how they learn to facilitate PBL.

Teachers’ participation was completely voluntary and confidential (names are pseudonyms). Teachers could withdraw from the study at any time. All teacher participants were eager to participate in the interviews with the researcher.

School A

Alice

Alice had more than 20 years of teaching experience and 5 years of experience facilitating PBL. She had been implementing PBL into her geography curriculum with growing intensity throughout her teaching career. At the time of this study, Alice’s Grade 7 students were working in groups toward completing a project with a focus on designing an interactive presentation that would teach other students about a country of their choice.

Andy

During the study, Andy was facilitating PBL with his Grade 7 mathematics students. Andy had been teaching for ten years and had one year of experience teaching PBL. His students’ projects were focused on data management in small groups. While the specific questions addressed by the projects varied, all focused on the most economical way to travel to a certain country.

Annie

With more than 15 years of teaching experience and one year of PBL experience, Annie had been facilitating PBL with her Grade 7 French students during the time of this study. Project
questions varied from student to student, but collectively focused on promoting a Francophone country of their choice. At the time of this study, students were writing a French script in small groups and making a video about their country of choice.

**School B**

**Barbara**

A mathematics teacher with more than 10 years of experience teaching Grades 7 and 8 and with three years of experience in PBL, Barbara had received professional development in PBL and had been implementing PBL in her data management unit as part of her mathematics curriculum in partnership with her teaching partner. She was facilitating PBL with her students in grade 7 focused on the question, who is our school’s most typical student?

**Beth**

A Grade 7 English teacher with 5 years of teaching experience, Beth had implemented PBL in her English program to motivate her students. At the time of this study, she and her students were focused on a PBL project with the overarching question, how do we raise awareness of residential schools?

**Brad**

A science teacher for more than 14 years and former Science Department Coordinator, Brad had been implementing PBL in his curricular program with growing intensity over the last 10 years and had been involved in professional development related to PBL that was offered at a national level. Many of his students’ projects involved on-site construction at his school. During this study, Brad’s students were involved in PBL on the topic of biodiversity. Student projects were focused on the question, how might we improve biodiversity at our school?
**Brenda**

An English teacher to Grades 6 and 8, Brenda had been teaching English for more than 10 years. During this study, students completed a PBL project with an international focus in which they collaborated online with students from other countries and cities. The projects focused on the question, what common questions do students ask?

**Brooke**

Brooke had more than 10 years of teaching experience teaching Grade 6 and 7 science and had been implementing PBL in her science program in partnership with Brad over the last three years. During this study, Brooke’s students’ projects were focused around the question, how do we remove water pollutants from our local nature reserve?

**School C**

**Cara**

With more than 35 years of experience in education teaching multiple grades, and as a former vice principal. Cara had been facilitating PBL with her students for more than 8 years. At the time of this study, Cara’s Grade 5 French students were completing projects on a range of student-selected topics with a focus on global awareness. In her class, students were grouped by common interest. Each group was then mentored by Cara as well as by other teachers outside of Cara’s classroom.

**Cathy**

Cathy had been teaching PBL for more than 8 years and had more than 10 years of teaching experience. Cathy had attended formal professional development in facilitating collaborative work. She regularly engaged in informal professional development opportunities within her school along with other teachers. Cathy worked closely with Cara in facilitating the
grade 5 projects. Sharing the same students, Cathy worked with the Grade 5 students on the English components of their project to ensure that each project was produced in both French and English. In addition, Cathy also mentored two of the student groups. Table 1 provides an overview of the teacher participants.

Table 1

**Overview of Teacher Participants**

<table>
<thead>
<tr>
<th>Teacher</th>
<th>Subject and Grade</th>
<th>Teaching Experience</th>
<th>PBL Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annie</td>
<td>Grade 7 French</td>
<td>15 years</td>
<td>3 years</td>
</tr>
<tr>
<td>Andy</td>
<td>Grade 7 Math</td>
<td>10 years</td>
<td>1 year</td>
</tr>
<tr>
<td>Alice</td>
<td>Grade 7 Geography</td>
<td>20 years</td>
<td>5 years</td>
</tr>
<tr>
<td>Brad</td>
<td>Grade 6 Science</td>
<td>13 years</td>
<td>10 years</td>
</tr>
<tr>
<td>Brooke</td>
<td>Grade 7 Science</td>
<td>10 years</td>
<td>3 years</td>
</tr>
<tr>
<td>Beth</td>
<td>Grade 7 English</td>
<td>5 years</td>
<td>1 year</td>
</tr>
<tr>
<td>Brenda</td>
<td>Grade 6 and 8 English</td>
<td>10 years</td>
<td>4 years</td>
</tr>
<tr>
<td>Barbara</td>
<td>Grade 7 and 8 Math</td>
<td>10 years</td>
<td>3 years</td>
</tr>
<tr>
<td>Cara</td>
<td>Grade 5 French and Math</td>
<td>35 years</td>
<td>8 years</td>
</tr>
<tr>
<td>Cathy</td>
<td>Grade 5 English</td>
<td>10 years</td>
<td>8 years</td>
</tr>
</tbody>
</table>

**Data Collection**

After a conversation with each teacher about the study, a date and time was agreed upon for conducting a short preliminary interview and class observation. Observations were conducted prior to the interviews to ensure that the researcher had an understanding of the context of the teaching and learning teachers were engaged in at each school site. Observations and interviews across the three sites were spread out over a number of weeks and efficiency of the interviews
was kept in mind to avoid getting too conversational with participants. Site visits ranged from 4 to 7 hours with observations taking place inconspicuously and discretely.

During the preliminary interview, which lasted about 20 minutes, the researcher asked the teacher to describe what the researcher should expect to observe during the observation. Class observations were conducted shortly after the preliminary interviews for the duration of at least one class period (typically 50 minutes). In preparation for the class period observation, the researcher requested a general overview of the period structure and any other supporting documents that might help the researcher understand the teacher’s facilitation of PBL in their subject area. The researcher took field notes during classroom observations on an observation template (see Appendix C).

After the preliminary interview and the observation, a second interview with each participant was conducted. This interview was held in a quiet room in the school and lasted about 45 minutes. The purpose of the interviews was to have teachers express their perceptions of facilitating PBL and their perceptions of how they learn to collaborate throughout the process of PBL. The second interviews were arranged around each teacher participants’ schedule. In School A, the second interview took place a week after the preliminary interview and observation. In School B, the second interview took place immediately following the preliminary interview and the observation. In School C, the second interview took place three weeks after the preliminary interview and observation.

The interviews with each participant were semi-structured. Interview questions for each participant were formulated and presented in a neutral way in order to avoid suggesting to participants that the researcher expected particular kinds of responses. The interview questions are listed in Appendix D. Acquiescence bias where a tendency to agree with and be positive
about responses was minimized by the researcher refraining from sharing her knowledge on the topic and responding neutrally to responses. The researcher simply stated that she was interested in learning more about what teachers had to learn during project based learning.

Socially desirable responses were minimized through the phrasing of the questions, which may have helped participants express more freely. To minimize confirmation bias, impressions of participants were continually re-evaluated to challenge the researcher’s pre-existing assumptions and hypotheses about learning through project based learning. Field notes, interview transcripts, and codes were shared with a colleague, the thesis supervisor, and thesis committee and participants’ responses to interview questions were reiterated to each participant to ensure the researcher had accurately understood each participant’s responses to the questions.

Interviews were recorded and transcribed by the researcher. The researcher also listened to the recordings several times, in different instances, prior to transcribing. Once transcribed in Microsoft Word, transcriptions were converted into a table that separated the teacher responses by sentence. The table was then copied into a Microsoft Excel document for analysis.

Data Analysis

The researcher analyzed the qualitative data by examining field notes from the preliminary interviews, observational notes taken during class observations, and interview transcripts the researcher personally prepared after the interviews from audio recordings. The thesis research questions were kept firmly in mind during the analysis of observations, field notes, and interview transcripts. In Excel, each transcript was entered in the first column of a sheet, with each sentence in a cell. The researcher used in vivo coding, noting a word or phrase derived from the response in the second column. The researcher recorded each code beside the
corresponding sentence. The codes in the second column were then reviewed by the researcher and a third column was added for specific notes related to each coded sentence.

A secondary analysis using pattern coding identified themes within the transcripts (Saldaña, 2013). The responses were grouped based on the emerging themes and colour-coded. The researcher selected orange for giving and receiving support, pink for challenges in facilitation and control, green for challenges in assessment and project design, yellow for memorable quotes, blue for teacher beliefs about collaboration, cross-curricular and cross-grade learning, and purple for technology. The researcher then re-grouped the transcript data by theme in a Word document and reviewed corresponding observations and field notes. Where appropriate, some themes were combined and then re-organized in relation to the research question. Overall, the researcher identified three overarching themes.

Interviewing more than one participant at each site made it possible for the researcher to compare responses among and between participants, both within and across schools. Each data set was reviewed for each teacher and then compared within a school. Following this, the researcher engaged in cross-group comparison (Miles & Huberman, 1994). Categories from the within- and across-group comparisons were then organized in relation to the research question. From the three overarching themes, the researcher identified three categories that related to the research question. Within each category, the researcher also identified sub-categories. The categories and sub-categories are discussed in relation to the research question in the following chapter.

**Summary**

This qualitative study was conducted at three independent, co-educational elementary schools. Semi-structured interviews were conducted with ten teachers: three from School A, 5
from School B, and 2 from School C. The interviews were audio-recorded, transcribed, coded, and analyzed by the researcher. The researcher identified three overarching themes from the data. Interview responses as they relate to the categories are discussed in relation to the research question in the following chapter.
Chapter 4: Findings and Discussion

The purpose of this study was to investigate elementary school teachers’ perspectives about learning through collaborative experiences in PBL and to better understand what and how they learn in PBL both from and with other teachers and from and with their students. The findings were organized by categories that emerged from the qualitative data, which included observations, field notes, and interview transcripts. 1. Learning through experience in PBL; 2. Learning through support in PBL; and 3. Learning through the unexpected in PBL. These categories and subcategories are summarized in Table 2. Discussion of the findings will be organized by these categories and subcategories.
Table 2

*Categories and Subcategories from the Qualitative Data*

<table>
<thead>
<tr>
<th>Categories</th>
<th>Subcategories</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Learning through experience in PBL</td>
<td>Collaboration in PBL</td>
</tr>
<tr>
<td></td>
<td>Cross-curricular collaboration</td>
</tr>
<tr>
<td></td>
<td>Learning to assess collaborative work</td>
</tr>
<tr>
<td>2. Learning through support in PBL</td>
<td>Informal learning opportunities</td>
</tr>
<tr>
<td></td>
<td>Support from other teachers</td>
</tr>
<tr>
<td></td>
<td>Support from administrators</td>
</tr>
<tr>
<td></td>
<td>Support from the community</td>
</tr>
<tr>
<td></td>
<td>Support from technology</td>
</tr>
<tr>
<td></td>
<td>Formal learning opportunities</td>
</tr>
<tr>
<td>3. Learning through the unexpected in PBL</td>
<td>Student-centred learning</td>
</tr>
<tr>
<td></td>
<td>Planning and instruction time</td>
</tr>
</tbody>
</table>

The three categories reflect what and how teachers learn in the context of PBL, both from and with other teachers and from and with their students and relates to the conceptual framework outlined in Chapter 2.

The first category, learning through experience, relates to teachers’ classroom practice as it reflects what teachers reported in terms of their learning through experiencing PBL. This category reflects what teachers learned through their collaboration with other teachers and students. This category also reflects new learning that teachers reported they acquired through assessing students’ project work.

The second category, learning through support, relates to teachers’ acquisition of new knowledge and skills through giving and receiving support within the context of PBL. This
category reflects new knowledge and skills teachers acquired through formal and informal learning opportunities supported by a variety of sources, including other teachers, administrators, the school community, and technology.

The third category, learning through the unexpected in PBL, relates to teachers’ beliefs and attitudes around student-centred learning, control, time for planning and reflection, and motivation. This category reflects teachers’ reported learning through experiencing challenges and unforeseen circumstances that developed throughout the course of PBL facilitation.

These categories and subcategories are now discussed in relation to each school and their respective teacher participants.

**School Context**

**School A**

In School A, PBL had been implemented in several grades throughout the school. Teachers had been using PBL both independently and in small groups with other teachers for 2 years. A group of Grade 7 teachers had been involved in a cross-curricular project with a focus on French, geography, and math. Collectively, the teachers taught two sections of Grade 7. Students worked collaboratively in groups of three across each of their subjects for about 6 weeks. The teachers worked collaboratively to plan and discuss curricular links. Questions for the cross-curricular project varied, but had a focus on Francophone countries. Templates for student tracking, rubrics, progress monitoring, and student observation and participation were generated by the teachers and shared for project alignment across subjects. Students were encouraged to work both in their classrooms and in spaces around the school.
School B

Teachers’ experience with PBL at School B ranged from 1 to 4 years. Beth, Brenda, and Brooke had been gradually implementing PBL in their units of study. Barbara and Brad had implemented PBL in several units of study over the past 4 years. All were involved in PBL work with their students during the time of this study. Brooke and Brad, the two science teachers, had each been involved in PBL that linked to their science curriculum. Beth and Brenda had been involved in PBL that linked to their English curriculum and also incorporated social justice and empathy. Barbara had been using PBL in her math classes to teach data management. The PBL projects in each of the teachers’ classes were gaining popularity at the school and other teachers were taking interest. On an administrative level, PBL had recently been included in strategic planning at the school. All five teachers at School B indicated that Brad had been instrumental in their interest in PBL and had assisted them throughout their own implementation.

School C

At School C, Cara and Cathy had been working collaboratively on PBL projects with their grade 5 students for 8 years. PBL was used as an instructional practice within their IB curriculum. Cara guided students through their French and math components, and Cathy guided students through their English components. Both classrooms had a similar layout that suited the needs of group project work. The teachers, with input from the students, grouped students based on their students’ interest in an overarching topic. Both classrooms were brightly lit with natural light. Posters outlining the IB Learner Profile in French hung on the walls in Cara’s classroom and in English in Cathy’s classroom. At the time of the study, a school-wide program had been recently implemented to engage teachers and students together in regular discussions about real-world problems. Every week, teachers were provided with the question to be discussed. Each
teacher in the school was assigned a group of approximately 10 students with whom they met each Monday during a scheduled period. The groups remained the same for a two-year period.

1. Learning through experience in PBL

Across the three schools, teachers described their role in PBL as that of a “mediator” or “facilitator” of student learning. Teacher participants explained that they have learned to improve their facilitation of PBL through their experience with students and teachers from project to project. In this study, teachers said that they have learned new skills necessary for facilitating effective PBL and that they continued to learn from and with their students and other teachers through engaging in PBL. This is consistent with Timperley’s (2007) description of teacher learning as reliant on the interdependence of individuals through their social interaction, support, and collaboration.

School A

All three teachers at School A stated that facilitating PBL requires skilled teaching that includes getting to know students well. Andy described his role in PBL as “all about asking them the questions and pushing them to answer those questions.” He also explained that he has learned what to adjust from project to project: “We see how each initial project goes and then hopefully we learn from it and change it for next time.”

Annie explained she has found that she has learned how to “sneak in the grammar they need, but also provide opportunities from them to be creative.” She also expressed that students require guidance in PBL and that for her, providing this is informed by her experience.

There are things that need to be guided. Bringing them back to the timeline – we need the script done, OK? I think experience – having taught lots of different ways and different
projects – having some go better than others, it’s a lot of that. Tweaking things every year. There is always the chance to refine the project.

Alice also explained that through PBL in her geography class, she has found her students are motivated when she is. She stated, “Students need to see that you’re passionate about it. The students know when it’s good teaching and so do I.”

**School B**

Beth described that, in her experience, she has learned that PBL has “the potential to reach all students.” Like Andy, she saw herself as a motivator and learned how to better identify students requiring more support for success in PBL. She asserted that her experience in PBL has helped her develop skills necessary for supporting students.

I think as a teacher, you have to say, yes, this is super open-ended, you have to give them suggestions, you have to give them ideas, you have to link things for them. Some students need that more laid out for them. Like anything, some kids are more successful in art, some are more successful in math. I mean, in PBL there is something for everyone. Each student might be doing something different, but you need to get what you can out of them.

She noted that this is an area in which she wants to continue to grow.

The students that struggle, they struggle with everything. It’s not the PBL. You can tell who is going to run with it and who is going to need a lot of support. Being able to guide some of them better, that is a bigger skill I’d like to improve on for next year.

Interestingly, Beth highlighted the challenge of supporting students in PBL. She admitted that working with students who are less motivated can demotivate group members and can demotivate her as well.

As a facilitator, a motivator, that’s how I see myself. You want to be with the kids. You have to divide your time between the excited passionate group but also having to visit the group that needs significant help and I’d rather be with the excited passionate group! But I need to go where I am needed.
Similarly, Brad said that, through his experience in PBL, he has learned to “go wherever the sharpest tool is” in order to provide support for his students. He acknowledged that it is challenging to be there for all of his students all of the time.

My sort of philosophy was, I’ll go wherever the sharpest tool is, and that’s where I’ll put myself, if kids need to go outside and dig a hole because that’s what they need to do, I’m okay with that, and I think my admin is going to be okay with that, because we’ve talked about it, [the students] know to be safe, and I can trust that they’re not going to goof around.

Brad and Barbara explained that having experience in PBL has helped them better understand PBL. Brad described PBL as three “phases or parts” that include “a discussion with students, observing students, and then a product.” He also described that he views PBL as “a creative process” that pushes students to “try to understand a large unwieldy question and make sense of it.” Barbara described PBL as “a practice that drives student learning, where students are learning the content and skills that they need to learn through the project so the project drives what the kids are doing.” She expressed that she has had to adjust to a busier pace in teaching PBL, but that she is motivated by her students.

It’s a ton of work and much busier. It’s a lot easier to just say here’s this topic and here’s this project, but when you see engagement and when you see kids excited, you know they are getting something out of it that they might not have if it was presented another way.

She also explained that PBL was helping to motivate students to learn math.

You know math tends to be a polarizing subject for many and it’s nice to have, for the most part, kids that want to come to math class and that’s really nice, right? It doesn’t mean they all feel 100% confident in their skills but, you know, you want to build an environment where kids want to be there and I think project based learning is helping with that.

Barbara also discussed that it is important that her students build skills in mathematics prior to application in PBL. Without skilled mathematics teaching that recognizes the importance of scaffolding, Barbara cautioned that students may be impacted negatively later on.

Math we continue to struggle with. I think math more than any other subject, because it’s so content-driven and it’s very, it’s almost like a ladder where you have to get to this step
to get to this step. It’s not like you can say, well, I never got to adding fractions so... but it is a big deal because of the math curriculum. Whereas in other subjects like social studies, it’s more skill-based, in that, do you know how to research? Do you know how to think critically and critically pick sources? Whether or not you know something specific about a particular war isn’t going to impact you later on. It’s, do you know how to look that information up? What’s good, what isn’t – so it’s a little bit different. The nitty-gritty isn’t as important in some subjects as it is in other subjects.

Barbara also explained that careful consideration and planning was undertaken in designing PBL in mathematics. She explained why she decided to start with data management.

Down the road when you get into calculus and things you understand when you’re learning the basics of algebra, but it’s almost learning letters before you can speak. It doesn’t make sense until you get there. So, we’ve started with a couple of units like measurement and data management that we felt were more kind of applicable and easier to kind of transition into and then created a project to drive the learning and making sure that we hit on the big things we need to hit on, but then it’s very engaging for the students.

Although Barbara has embraced PBL as a teaching method in mathematics, she explained that she feels it is important to consider other teaching methods as well.

I’m not saying this is a trend per se, but I also do think that all of the different methods, including direct instruction, including constructivist things, they are all important and they all have their place. So, I don’t think that one way is the be all and end all. So, I see myself having some units that are project based and some that are not, and that’s OK.

Similarly, Brenda highlighted the importance of skill development in English. Through her experience, she has also found that students require some direct instruction prior to PBL project work.

The thing with me for next year, we need to be able to say, before we start our next project, here’s some skills you need. So, we are going to have some more formalized learning for two weeks because you’re missing these skills, and then now you’re ready to do this. That’s what I’m anticipating for the fall. I really see that as essential. You can’t expect people to make connections to other things in the world if you haven’t exposed them to other things. There is a certain level of knowledge that is required in order to be effective in an open-ended environment.

Brenda worried about students developing their skills through PBL, but through providing some “mini-lessons” on certain skills, she felt that the students were better prepared to pursue PBL in her English class.
Brad explained that years ago he was “already trying to encompass the whole process of observing and analyzing and thinking and applying and communicating” through science fair projects in class. However, he described changing over time in response to his teaching experiences and his student-centred approach to teaching and learning. He explained that learning with his students changed the way he thought about teaching.

What happened to me during that time was kind of a mini project based learning … I had to figure out how to support them individually. So, I got away from the front of the class and I got on the side of learning with the students. So, I was with them, learning with them at the same time and that really changed the way I thought about teaching because I had very, very rich discussions and I made authentic observations of what students were actually doing and I saw their product at the end, so I knew more than anyone what the process was and what the real learning was, so I valued that and I realized that that was in a sense kind of [an] introduction to project based learning.

In facilitating PBL with his students, Brad explained, he had recognized the importance of the students’ final presentation and mentioned that “it really makes them step up their game.” He described how his experience in PBL helped him organize a meaningful product showcase.

Wrapping it up, I thought, what can we do to really give them a chance to showcase and really sink in the message? I invited the herbarium specialist back to us. We had tables set up with a bunch of static projects, and we had tours, where the boys and girls would bring them up here where I told them they had to have a 30-second version of your project, a 2-minute version and a 5-minute version of their project in case you get extra amounts of time with these experts, so it validated all of their work and it really drove home their learning.

Reflecting back on her experience in PBL, Brenda also shared that she felt that rich learning had taken place through the student projects and that students had made some unexpected gains in terms of social-emotional learning. This was something that Brenda had not anticipated during the international collaboration project.

It was kind of a social project because some of them video-taped their thing and said, “Hi, I’m Bobby, I was Ben’s buddy and this is what I really liked about working with you.” And I said, “If you had known that the person looked the way they looked, would you have chosen them as a partner? Be honest and tell me why.” And many of them were like, no, yes, not sure, “I didn’t even know she was a girl!” So, it was really interesting for sure. What we got out of it was incredible.
Brenda asserted, “I feel that engagement is huge in PBL.” She explained that students have reported that they enjoy PBL and have described enjoying a sense of ownership for their learning. She recalled a conversation with one of her students:

One of the kids just said to me after she came back from doing interviews for her project. She said, “I’m so excited, I just love this project!” And I said, “What is it that you like about this?” And she said, “I love the fact that we’re doing it. I feel so grown up!” And really, isn’t that what project based learning really is? Like you feel you are responsible for your learning, not that someone is telling you how you have to do it. We’re just giving them a framework to work in.

**School C**

In School C, like Beth and Brenda in School B, Cathy also asserted that she still has some direct instruction in her classes to ensure students have the literacy skills they need to independently pursue project work.

Students need to build their foundation. Like how are we going to incorporate spelling? We need to read texts to do our project work, so spelling is still somewhat of a standalone.

Cara also stressed that, while direct instruction of math skills is important, providing relevance in math through PBL is also important.

For me, math is the hardest to integrate into the projects. … The concept of fractions, the concept of dividing pieces, how do you incorporate that? The math is tricky, but we do find connections. So, first I have them use the language of math, millions, billions, and then I ask them, if you want to be a billionaire, what field should you choose to work in? So, I incorporate data management and statistics. When they go back and find who was the richest in the 1920s, I say, “how many women did you see?” and they are like, “wow!” That’s where they learn that it was a man-driven society. … They can go off on a tangent, but you have to bring them back and it’s more engaging than just telling them what to do. I’ve learned giving them a story of today that is relevant and provides context to math is very important.

Cara explained that despite having years of experience, she is still working collaboratively with other teachers toward incorporating math into PBL. She expressed that, “after 8 years of working on math in PBL, we still aren’t there yet.”
For Cathy, working with students on a variety of topics in PBL has helped her develop questions that are helpful for students’ task-initiation. She provided an example.

When we start a unit, there are tons of questions, it kind of starts off like an explosion, especially when it is group work. I ask questions and they ask questions too. If they don’t come up with questions, I will ask some and try to get them thinking. Sometimes they remember topics from older kids and their exhibitions, and sometimes they know from an older sibling. In my experience, I have learned that if we are studying ‘Sharing the Planet’, you can almost always guarantee that a student will pick an endangered animal to study.

Cathy also expressed that while she may repeat projects with students from year to year, the projects are never the same: “you could do the same grade and unit next year, but the kids will make it different.” She provided an example.

One unit, I’ve been doing it for five years, and this year’s group is really artsy and so this year it is so different from what I’ve done other years.

She also stressed that “experience helps” and that as a teacher “you get to the point where people trust you more and you gain some credibility over the years.” She further explained how her experience in PBL has helped her improve her PBL teaching and noted that she has had to develop new classroom management strategies that she has aligned with Cara’s.

If I had done this when I had first started teaching, because you need to have your classroom management skills really honed, it would have been a nightmare! I now have my bag of tricks with what works with the kids.

**Collaboration in PBL**

Across the three schools, teachers described learning through collaboration both with and among their students and with and among other teachers. All teachers across the three schools expressed that they had learned how to facilitate collaborative experiences through their experience with PBL. Teachers also expressed that they valued the learning that took place through collaboration in PBL. This connects to research by Richardson and Placier (2001) who assert that teachers’ professional learning is based on their personal growth as well as their collaboration within the organization in which they work and learn.
School A

Annie described her experience with the group work in her French classes. Her large classroom was light-filled with desks for 22 students configured in a large U-shape. Bulletin boards lined one wall with student posters and conjugation rules. Annie explained that the classroom is set up for use by students in other grades and classes and that her students don’t necessarily sit in rows. In French class, students were focused on creating a script that would teach others about travelling to a specific Francophone country. In her experience collaborating with the students, she expressed that she has increased her own knowledge of French-speaking nations and other cultures. She also described that through group work in her class, students have the chance to work individually as well as collaboratively.

In the planning stage, each group member did their own individual plan. What are my ideas of where the dialogue can go? Then they sat down and read their ideas to the group, then they made a plan. Students ended up using each other’s ideas to make their own dialogue. That was learning for them. I’ve learned that three is a good number. One can be away, and two can press on. Four, you end up with two groups of two and not as much collaboration. They learn through that process.

Annie felt strongly about social collaboration in her French class. She explained that working collaboratively on the script was helpful for her students.

They communicate fairly well orally, but getting it down on paper in a grammatically correct, coherent message is tricky! I’ve seen that they don’t particularly like writing it down, so it’s hard, but by doing it with a group, it, I think it makes it more accessible. They share more ideas. Maybe you don’t know how to say a certain word, but I do! And the other group member is grabbing a dictionary and another is saying a certain word, another is looking up another word. So, putting your heads together, I think that the end product is richer and I think that’s a gain.

Annie described that “students enjoy it” and that it is a big gain for her students because she felt that “writing in French can be intimidating.” Annie also explained that working in groups to learn about Francophone countries, the project “helps open their eyes to the fact that French isn’t just spoken in France” and that in having students working on a script about a Francophone country other than France, she is moving the discussion to the students. She stated, “It’s
embarrassing to admit this, but it’s not a discussion I’ve had with my classes before, so it’s great that they have started that discussion together.”

Andy also shared this perspective. His math classroom was bright, with desks arranged in groups of four and five. A large wall of windows provided a view to the school playground and a wall of white boards lined another. For the math component, students were required to determine efficient and economical travel itineraries to the French countries. He explained that working collaboratively has helped his students demonstrate accountability.

For me, since my first PBL data management project, the biggest gain I’ve seen from students working together is them showing initiative and taking responsibility for their learning.

Andy expressed that he viewed having the students work on data management that connected to their research in French and geography as an opportunity to “make it as exciting as possible in terms of introducing what I am teaching them in math.” He explained that in math, he was able to teach a lesson so that students learned the skills required to solve the questions they were seeking answers to for their PBL projects. Andy also explained that, because students were comfortable with their group members, he could “push them to answer questions” and “accomplish a balance between teacher-directed lessons and PBL.”

Alice’s classroom was set up similarly to Annie’s, but with a large map of the world with several countries’ corresponding flags. Alice explained that the map was representative of the students’ research that linked to their French class with Annie and their math class with Andy. From Annie’s perspective, maintaining group cohesion could be challenging at times, given that students work together in the same groups across subjects.

The fact that for these projects students have to be in the same groups in all of the subjects - that’s a challenge for students. It’s a challenge for us too, but through it all we learn together how to make it work.
Alice explained that because the students maintain their groups, tracking their progress from class to class was achieved using a common tracking sheet that Alice had constructed for each teacher to use. She explained that using the same tracking sheet helped her and other teachers “understand the full scope of the project” and helped teachers provide the students with support that went beyond their own subject of instruction.

**School B**

Brad and Brooke’s science classrooms had a traditional science lab layout with sinks, and long black countertops with stools. Windows lined one wall of the classroom. The science teachers explained that the classrooms were being prepared for renovations that would improve the classrooms for collaboration, with greater desk space for group work and project building. Terrariums, aquariums, and project models filled the tables by the windows. On one bulletin board, project question prompts for students were on display and a student-constructed bulletin board on the water cycle was featured on another. Students eagerly checked on their habitats and a few boys fed some fish and turtles.

Brooke was excited to explain a project that her Grade 7 students were currently involved in. “Come see my crime scene! The principal wanted to video it! It was so exciting! Engagement all around even from our principal.” In a shared office, a skeleton was set up on the floor, dressed in school sweats. A caution tape roped off the scene. Brooke explained that this was a considered a crime scene until the students could determine what might have been the cause of death. Brooke explained that it was throughout observing Brad facilitating PBL that she became interested in facilitating PBL herself.

To me, what I thought of PBL has changed. I had seen a colleague of mine doing it for years … It’s cluttered, the kids are everywhere, you are everywhere, students constantly need this, that, and the other thing, which is fine, but I was like, what’s going on in there? It looks like chaos is going on! The kids are all doing something for the most part, but
initially I thought it was this really chaotic, open-ended, super uncontrollable entity. Now that I’ve tried it, it’s not as chaotic and crazy as I thought it would be.

Brooke recalled learning through her experience in PBL. She described a now “hilarious situation” in which she and her students experienced a failed experiment.

Hilarious situation – sometimes you are going to fail miserably. We were making something in class, like a slime that when you hit it hard it is hard, but if you just press on it softly you can melt into it. We got all ready, lab coats, and it just wasn’t working. We followed it step by step and repeated the process. Then one of the students said, “Ma’am, this is baking soda!” Oh gosh, it was supposed to be corn starch!

She expressed that she has learned to “find humour in every situation so that your students aren’t developing negative ties to every failure.” She explained that in working collaboratively with her students, she has to “think like a student.”

I have to be able to laugh about it. It’s OK to make mistakes – we are going to do it again if we totally bomb today! If it had been in front of my peers or colleagues I would have been completely devastated! Like go crawl under a rock! But in front of the students I was OK. Again, having these experiences is good for the kids and it’s also good for me, to think like a student. When you ask them to step out of their comfort zone, that is so hard, especially during these middle years when their peers are so important.

Brad also expressed that he learned through working collaboratively with his students. Many of Brad’s students had an interest in school improvement and had been involved in a number of building projects such as ponds and gardens on school property. He referred to a group of boys who had built an elevated box pond for fish and turtles as ‘The Box Pond Boys’ and explained what he learned through collaborating with them on their project.

What I learned from my students is that the whole is so much greater than the sum of its parts and the serendipity that you can’t plan for or imagine will happen. A project can be a disaster for so long and then they learn that in order to get to the idea at the end, they have to approach it a different way. That for me is very powerful, when the kids know they are onto something big, and you don’t know where it’s going to go.

Brad described collaboration both across and between students, with other teachers, and with the broader community that developed as a result of PBL in his science classes. He explained that he has learned through past PBL projects that the involvement of ‘experts’ had
increased students’ presentation quality. He further explained what he learned about collaboration through PBL.

There is a collaborative process in the middle where they need to work with each other, or work with the teacher, or work with experts or work with the Director of Operations, for example, to find out if they can even make an installation on our property. I think more importantly, I have realized that the component at the end where there is a public presentation or forum of some kind where they share their process and their product, not just with the teacher, but with an intended audience. Whether it’s the squirrels outside, or politicians, or it’s experts, it’s an authentic audience. They step up their level of performance. And that’s something I’ve changed this year from last year.

Brad also explained how students collaborated across class sections. He asserted that collaborating across class sections increased the complexity of collaboration and forced the students to develop their own collaborative systems. He described the collaboration as “very organic” and expressed that it “changed over time.”

There were four classes in the same grade, so they could work across classes if they wanted to, or within their class, or on their own too. It became challenging from a logistical point of view because they would need to leave off key steps. They needed to take over from where we left off, so that took a lot of collaborative effort and planning on their part.

Brad also explained that the collaboration in PBL went beyond the classroom level. In the case of his science classes, collaborative learning also took place at the administrative level for both him and his students. He explained that collaborating with the Director of Operations and maintenance staff helped both him and his students with their PBL work in science class.

I’ve sent them down to the Director of Operations. I’ve said, you know what, I can’t make a decision like that. If you want to install a green, living structure in the place of a couch that you think needs replacing, sounds good to me, but I can’t make the decision on that. You have to prepare a proposal and make an appointment and go see our Director of Operations, and tell him what your plan is and see what he thinks. You know, in the end, you ask the kids, who did you collaborate with? Your partner, yes, and you also collaborated with the Director of Operations, and the guys from maintenance, and the Grade 3 teacher – they sort of [see] the importance of their work.

In the English classrooms, posters outlining the writing process filled the space above the green chalkboards that lined one wall. Windows spanned another wall and students worked at
desks in groups of four. Beth explained that the current PBL project developed unexpectedly after attending Me to We Day. The event had featured Gord Downie of the Canadian band, The Tragically Hip. She explained that Gord Downie’s speech “left all of us inspired” and explained how this inspired the development of PBL back at the school.

So, we had a whole brainstorm session and just listed all of the questions we had about residential schools and reconciliation, and really one or two or three students actually knew what a residential school was. And we were like, oh my god, this is awful, this is horrible! So, then we did a big mind map and brainstormed ideas and compared what we learned. And I said, what do you think could help this? Is there something that should be done to help? What are your ideas? And in each of my three classes, we all came to the same conclusion – and that was we need to educate people about this.

Beth explained that students decided that the school should participate in Orange T-Shirt Day, in which people can come together “in the spirit of reconciliation.” She further explained that, “through the teamwork, the learning was so rich for all of us.” She described a sense of empathy that she experienced in working with her students.

One group decided they had to do a chapel presentation to explain it to the school. They were really scared, but once they presented, they said, you know, that wasn’t as bad as I thought it would be. I mean, that’s how I feel! I don’t want to speak in front of everyone at chapel either! It was really hard for one student to get out of her comfort zone and she really knocked it out of the park.

Beth also explained that group work was challenging for some students:

Some of the students just struggled with group work. Some students took the high road and others just did nothing. It also helped to pair up groups. Like if I knew of another group in another class doing something similar or wanting to make a presentation in chapel too, then I’d approach that group. Having three or four groups mesh together really helped too. You saw amazing teamwork.

She also discussed the challenge of motivating students in collaborative work. She expressed, “You can have some really great moments, and some really disappointing moments.” She further explained what she had learned about motivation.

I’ve learned that task initiation is a huge part of success in PBL. Kids are either super motivated or just doing nothing. So that’s the hardest part. Try this. What do you think of this? Try this. How about this? Let’s do this, let’s do that. You have to ask them, what have you done in other classes? How can we piece this together? So, one of the biggest
lessons is about relationships and collaborative work. It’s a real-life skill and a tough lesson to learn.

Brenda described her Grade 6 English students’ current PBL project that involved a partnership with other international schools in which the students worked collaboratively to produce a presentation on commonly asked questions. She explained that one of the goals of the project was to learn how to design a presentation through virtual collaboration. She explained that “we wanted to learn how to put together a polished presentation with others” and “how to communicate in the online world” because “in the future, we could be working with someone in China to create a presentation.”

She explained that apart from knowing group members’ names, her students did not know anything else about their group members prior to the project. In collaborating with students they did not know, she explained that both she and her students learned to be flexible in order to provide students with the best collaborative experience possible.

Brenda also expressed that working collaboratively with Brad was beneficial for the students both in their English and science projects. She expressed,

To be able to have teachers in one space and to have teachers with different expertise in a common area was – like the collaboration was incredible then, right? So that’s why Brad and I really want to continue to work together next year, because he has the science expertise, but he wants me to work with them on the writing and how to make it polished.

Barbara also discussed learning with her students through PBL. She explained that she and her Grade 7 math students co-created a survey to help answer the question, what is our school’s most typical student? She described reading through the survey data with her students as “really interesting and something we had never really expected or come across before.” She explained that the data management project provoked interesting discussion and learning.

So I had a group of students that designed an online survey. Sent it out to the high school students, we got a whole bunch of online responses, and what was interesting about that
is that they got a whole bunch of responses that were clearly made up, that made no sense and the kids were like, what the heck, why would someone do that? That was really interesting for them to see that when people are out there collecting data, they do get some bogus responses, and how do you deal with them and what do you do?

Barbara also described working collaboratively with her teaching partner to incorporate PBL into the math program and how they collaboratively designed a data management project and how it differed from their approach to data management in the past.

It’s always been like, for myself and my teaching partner, like, oh man, the data management unit is coming up, this is how you survey, this is how you, you know, whose favourite colour is red? And talking about bias and what’s good about surveys and bad about surveys. Okay, now how do we present our data? So here’s a graph, here’s how we make this graph. So we did it, but … we felt like, it was really dry and didn’t necessarily connect. So this year we flipped it around and we asked, who is our school’s most typical student?

Barbara explained that through the survey, she and the students learned that the majority of students disliked a particular gym uniform and that the students decided to use the data to help them argue for a replacement. She explained that, “it just made the unit a lot more exciting, a lot more meaningful for them.”

In the end, they felt that they could go to our headmaster with what they found and educate him on some of the things they found and then it also allowed them to understand that it was important to make a graph to have something visible to back up what they were saying.

**School C**

At School C, both Cara and Cathy had been involved in a new school-wide initiative. With a focus on small-group discussion, teachers facilitated discussions with small groups of students from multiple grades. Discussions centred around a common question and involved the teacher mediating discussion. Cara described collaborating with her students during the school-wide group sessions and what she had learned through the experience.

For example, last week was, ‘do I need to obey my parents?’ You’re not supposed to have an opinion as a teacher, but you are supposed to encourage everyone to talk. You are a facilitator, you facilitate and ask, do you agree? Do you disagree? I’ve learned that in my group of Grade 5 and 6 students that the Grade 6s are much further ahead in their
thinking. The Grade 5s are great listeners. The other thing that I’ve learned that I love is that to agree or disagree, I give them Post-it notes and I put them on the board and then I’ll move them around and they will say, but don’t move me there, I agree! And I’ll say, “Great, but just pretend you don’t.” So that they can have the perspective of the other one, you know? It’s quite interesting. There is never a right or wrong answer. A couple of weeks ago the question was, ‘if you are dying of hunger, is it right to steal?’ And it was like, wow!

With over 35 years of experience, 8 of which she taught using PBL, Cara expressed that she learned a lot through collaborating with her students.

I’ve learned that in collaboration, you can’t just say, collaborate. Students have to have a plan when they collaborate. There has to be a to-do list, if you are all doing perspective, then are you working efficiently? They have to follow a plan and everyone has to contribute. It took me a while, but I really get it now. Sometimes we learn that [you] have to change things, and you have to open the project. If it’s too closed, then it risks becoming too thematic based. Linking the concept to the curriculum involves a lot of support and every teacher has to know their curriculum well to pull it off.

Cathy also stated that she has seen the benefits of group work with her students and that she has learned to outline clear expectations for her students to ensure their success.

I’ve seen students who are not stereotypically strong students become so successful. A shy, reserved student will be totally engaged in a group when they know what they have to do.

She also recalled a particular school year in which she had a new student involved in group work with other students. She described how group work in PBL helped the student become more independent.

I remember one of my students several years ago – she couldn’t line up, she couldn’t share with her peers or work in a group, and now that I see her almost three years later, it’s amazing what she has done. When she arrived, she had no independence, she wanted me to be her personal dictionary. The group work totally helped her, like she had to collaborate more. … [T]his learning for her also spilled over from the classroom to the playground. For me, that’s what I like to get out of it. It was great to see her gain independence from working in the group with other kids.

**Cross-curricular collaboration in PBL**

All teachers across the three schools also described cross-curricular aspects of PBL as learning opportunities for both students and teachers. Many teachers described that their
involvement in PBL had led to an interest in cross-curricular work. Teachers expressed that, through PBL, they had learned about potential curricular connections beyond their subject focus from other colleagues and also from their students. Overall, teachers asserted that their students benefit from cross-curricular work in PBL.

**School A**

Cross-curricular collaboration was part of the Grade 7 PBL projects at School A. Alice, Andy, and Annie shared the view that cross-curricular work provided their students with a positive learning experience. Together, the three teachers had designed a cross-curricular framework that provided students with several periods of class time per week. Annie asserted that this cross-curricular approach provided students with more time to work on their projects, which ultimately aided students in their overall French projects. She believed that the cross-curricular projects helped her students achieve a level of learning that she could not have provided her students on her own.

What they picked up in geography class, they can apply that knowledge, even when they don’t realize it, in their French project or in their music project. It’s just so much more learning that I could not do as a subject teacher, seeing them not even every day in their second language. I couldn’t hope to build up that kind of understanding.

**School B**

Brenda realized the potential cross-curricular opportunities that she could provide her English students next year. She explained that, in facilitating PBL, she had realized how the residential schools and reconciliation project could be extended into other subject areas.

It’s cross-curricular. That’s a big thing to realize. So this particular project in English would be so relevant and applicable in history and social studies. It could even be cross-curricular in music. So, like something I’ve done in the past, when the kids are doing poetry, I’ve had them write music for it. What do you think is going to go with your poem? You explain it in a really intricate way and then you realize they are writing songs! You are having them understand mood in poetry and also mood in music. So, music and English can definitely work well together.
Barbara also expressed a desire to engage in more cross-curricular work in her math classes and explained how, through her experience, she had learned to identify other potential project links for other subjects. She explained some of her ideas.

I’d like to do more cross-curricular work. I know they do carbon footprint in geography and so it would be cool to link those subjects together and also bring in environmental – maybe design packaging that is more eco-friendly, zero waste. Which package would have the greatest volume for the smallest surface area? Bringing in maybe English because they can do some advertising. So, you know, you’ve made this product, convince me that I should buy it and why. You know, bring in art to design a label for it. I’d like to do some cross-curricular [projects], but that all depends on time, especially middle school where we are very busy.

Barbara also recognized potential cross-curricular connections that could be made to extend her students’ data management PBL work. She believed that connections in PBL should be clearly tied to curricular goals.

Often in cross-curricular design we tend to say, there is our project. Oh, where does the math fit? Instead of, here’s my idea, make sure it fits, then see how it links and where it can go in terms of ties with the curriculum. You need to look at your curriculum as [a] piece of the planning.

Brad explained how he learned about curricular connections from other teachers. He described multiple connections to other subject areas, but indicated that not all connections can be realized due to scheduling challenges.

We did try to do something like a Dragon’s Den where we tried to make something that would help somebody. It involved physics, mechanics, parts, purpose, input, output and they also had to market it through language arts. I was hoping they could write a jingle for it, like a commercial. And then in social studies, my colleague … took an element of their product and looked at the manufacturing process of that piece and he said, well where would you source this from globally and what would have to happen to it? … So they would look at countries of origin, importing it and what kind of levels of change would happen to it over time and place … They had to design packaging for it as well in math. They had to design a net feature, so you’d take a piece of paper and you’d have to look at the final boxed shape of your product and what would it be, a tubular box, or a cylindrical shape or whatever, and then create a net that you could use for folding, to fold the box to meet the needs of that package shape with the minimum amount of surface area. So there were four or so subjects included there, with the added challenge of, well, we aren’t doing nets at that time of year and they don’t have geography right now, they have history, and that’s not what we’re doing in music right now.
Brad and Beth explained that they were in the process of planning cross-curricular projects for next year when a new schedule would allow them to co-teach their students. Teachers at School B expressed that in order to provide effective cross-curricular PBL for their students, they required scheduled time to both teach and plan collaboratively with other teachers. To meet this need, a new schedule that would provide scheduled times to teach and plan was being constructed for the following school year.

**School C**

At School C, Cathy explained, “Before we started this, we used to have different subjects to teach, and now we are more cross-curricular. I think that’s interesting.” Both Cara and Cathy acknowledged that teaching PBL in the IB program had required a shift from a thematic focus to a conceptual focus. Cara explained how things had changed.

> So like 35 years ago, we would get stuck in the form. Here is a leaf, this [is] what it looks like, this is the tree ... now it is, how did it get like this and why did it get this way? From here, differentiation happens in the concept, in the inquiry itself.

Cara expressed that cross-curricular integration is necessary for students in PBL and that “meeting with the other teachers has helped me with that.” She explained that she is “still learning” through the process.

> What’s nice about PBL is you start big. We focus on concepts and relationships. How do they work together? What is the relationship between them? So there is also function. If a question involves women’s rights, you need to know how that functions and how it functions around the world. You have to look at history. That’s when the phys. ed teacher gets involved and the art teacher gets involved. So I guess the interesting thing is we need to coordinate all of that. So we sit down and have a Skype meeting once per week with the other campus. We really learn about the possibilities.

Many teachers expressed that PBL had inspired them to explore further cross-curricular connections. However, many teachers with a desire to create cross-curricular opportunities for their students noted that they were unable to successfully provide such opportunities for their students without support.
Overall, teachers from all three participating schools reported that they learned through cross-curricular collaboration using technology and through their experience in facilitating PBL. Teachers also commented that, through reflecting on their PBL teaching experience, they learned to improve learning opportunities for their students, themselves, and other teachers.

**Learning to assess collaborative work in PBL**

Overall, teachers across the three schools described learning new assessment and evaluation practices through teaching PBL. Some teachers said they had experienced difficulty assessing student work in PBL and that they had learned to assess and evaluate PBL better through practice and in collaborating with other teachers. Teachers described that assessing PBL involved the development of benchmarks, goals, contracts, and student-designed rubrics that reflected both individual and group work.

**School A**

Annie said that her interest in PBL stemmed from her dissatisfaction with assessment of Core French. Annie believed that students’ written work alone did not adequately represent their understanding. She explained that when she realized that, “the more students could get into their work, the more relevant and more engaging their work was”, she began to incorporate more PBL, which prompted the development of new assessment practices. Annie explained that the cross curricular projects provided more opportunities for students to practise, improve, and apply their French vocabulary. Through creating a video and script, Annie explained, she could “see what they were thinking and how they have grown more than through their writing alone.”

Alice also explained that she has learned that PBL has to involve goals and benchmarks that help keep students focused on their end goal.
There has to be a goal, but you get to decide your resources and how you’re going to get to that goal. There are benchmarks and goals for the students and that’s important for keeping them on track.

Alice explained further that, in PBL, she had learned that celebrating benchmarks and goals as they are reached was important for motivating students. Acknowledging small gains was motivating for her students.

**School B**

At School B, Brad and Brooke reported that growing support for PBL from administration and other teachers had stimulated discussion around assessment in PBL. Brad indicated that the issues regarding assessment are well understood at his school and suggested that provincial policies and PD around assessment have helped teachers gain a perspective on assessment. Brad explained that he had been advocating for a shift away from grades entirely. He stated, “Growing Success [Ontario Ministry of Education’s document] has been a guiding light for us. It has helped a lot in terms of getting away from grades. My coordinator and director of academics understand the dilemma.” Brad adjusted assessment measures for his students in PBL.

I modified the student self-assessment documents for collaboration, creativity, and presentation skills. I took it and I turned it into student language, like ‘I Can’ statements, and I adapted it to our Growing Success interpretation of our indicator levels, so we have beginning, not yet, met [and] beginning, developing, accomplished, and exemplary. So I did something interesting with it, combined the early columns and I left the exemplary column blank. I posted it on Google Classroom, and I said, if you think that your project might be beyond expectations, then you need to describe it in your own words because it’s a unique project to you, if you feel that it demonstrates the highest level of accomplishment for this skill, then you have the skill to explain it in an exemplary way.

Brad also explained that providing students with ongoing feedback was difficult to manage.

There are a lot of other demands on me too, so it’s difficult to give the proper amount of feedback to each student, but having the students do a self-reflection on creativity and collaboration ... What I did instead was invest my time in my discussions that I had with each student because you know, oh, you’re going off the Junior school to round up some Grade 3s because you’re going to teach them how to make plant presses. I know you’re good, that sounds amazing, you’ve done a lot of preparation. And, okay, you guys are using tools, so let’s talk about safety. It’s an unbelievably open, dynamic, messy process.
Brad also indicated that assessment had recently been a PD topic at his school. He noted that, since the PD, teachers are discussing assessment more frequently and that discussing challenges they encounter in PBL is helping stimulate conversations among teachers. He shared his perceptions of other teachers and administrators at his school.

I think they’ve realized and they’re starting to do that now more and I have a lot more conversations, and I think we’ve all been trained so we understand assessment for learning, assessment of learning, assessment as learning. We are all seeing and hearing the posters that say, here is what standard learning is, here is what project based learning is – well, it’s authentic, it’s student-centred, it’s all those, you know, 21st century skills that we want. So everybody is sort of hearing that and starting to wonder, how can I do it? Well, if he is doing it, can I go and see it? Can I try? So I think that’s where we’re at.

Like Brad, Brenda also indicated that her assessment practice has evolved as she has gained experience in PBL. She explained that she has learned to incorporate students’ perspectives in rubric construction and how involving the students in the process helped them articulate their project goals.

So, what is our rubric going to look like? Is it going to be really complex? And the kids were like, not really, because we are focusing on these English skills, ma’am, we’re not focusing on whether or not I find the answer to my question. And so the rubric was very simple and that helped to calm them right down because they know what it was that they were trying to do. But they designed it, I didn’t design it.

Like Brenda, Beth worked with the students to build a rubric that reflected their project goals.

Marking the process was challenging. It’s almost like the students know that the final mark isn’t the most important thing. In fact, they aren’t like, what did I get, what did I get? So, the big thing we talked about together was how to build a rubric together.

She further explained how she assessed the students’ work with a focus on the process. Beth explained that, due to the dynamic nature of her students’ work, assessing them in a uniform way was challenging.

So, knowledge and communication marks – how you got the message across, an application mark – so, how they were able to pull together their final product. It was difficult to assess any unfinished products. I was pretty lenient. I honestly thought I had some 10 out of 10s. But really, overall, it’s about getting them to develop the ability to
get there. When the students compared their marks, they were able to see what other students were doing. I think that showing them exemplars and showing them the rubric and saying, this is what your product should be and should not be, I think that limited some of them. And if they are all doing something different, it makes it even harder to identify what is expected.

Beth also noted that Brad was helpful in sharing assessment guidelines he had learned through his PD opportunities and that she had found a number of assessment tools online that helped her design her own.

Brooke also expressed that assessment in PBL posed an ongoing challenge for her but that Brad’s support had been instrumental in easing her worry around grading of students’ work.

We’ve used the Ontario curriculum, but we’ve never said, we have to do these units. It’s more experiential. It’s not about the mark. If we could eliminate marks we would be so much happier. If we could just get rid of the percentage grade. We like the indicators – like, yes, this is developing or accomplished, or this is not quite yet met. So, on the report card, for science, there are four main learning skills, set by Growing Success.

Like other teachers at School B, Brooke mentioned that PBL had prompted conversations about assessment that focused on the process of learning, not just a final piece of work. She reported that, in order to assess the process of learning, she developed a “system of documentation using pictures and a running commentary” on Google Docs. She explained that, while this had been helpful, she is still struggling to assess each students’ project given the variation in student projects.

Some projects are done. … Some are detailed plans of our trip, some are notes from our fundraising campaign that we did, some are about a slide show that they made for assembly, and I will comment on them. Some kids did posters, some did brochures. … I have one group that came up with a plan for helophyte filters and how we would plant them, where they would be planted and how they would be maintained, versus the kids that came up with the fundraiser. How do I give them a mark? They’re not the same thing. It’s hard to give them an actual number. Like I’m struggling with giving a percentage grade right now. Brad said, don’t worry. See, that’s me, the control freak – the worry comes back.
School C

At school C, Cara described assessment in PBL as “truly about the whole process, not just the end product.” She also shared an example of how she had adjusted her assessment measures through facilitating the small mentoring groups with her Grade 5s and 6s. She explained that she used journals to help provide insight into what her students know and to better understand their thinking over time.

What I love, or what I’m getting better at – I always have a reflection-type activity. We have a journal because some students need to reflect before it comes out and plus it’s a trace for me to know – not that I necessarily read every word in their journals. It’s a way for me to know what we have done and also understand where is their thinking. So there are a couple of things I’ve learned through this.

Cathy expressed that through PBL, “students are being trained in terms of meeting expectations.” She explained how that worked.

Once they are working independently, it’s a lot of check-ins and facilitating. When we follow the writing process, for example, they write, they plan, they write, and then they have conferences – a group check-in, a peer-check-in or teacher check-in. They are learning to be accountable through the process.

Cathy also mentioned that collaborating with Cara was helpful in monitoring student progress, providing feedback, and assessing their students’ work throughout the process.

Overall, teachers across all three schools expressed that they learned to improve their facilitation of PBL through their experience with students from project to project. All teachers reported that, through engaging in PBL, they continued to learn new skills from and with their students and from and with other teachers.

2. Learning through support in PBL

The qualitative data in relation to support is discussed across the three schools in the following section. The teachers indicated that they received and relied on a variety of support that contributed to both their own learning and their students’ learning throughout the PBL.
process. Lave and Wenger (1991) refer to this as situated learning in which, through collaborative experience, individuals become part of a community of practice (CoP). Many teachers reported engaging in some type of professional learning in relation to PBL and sharing their expertise with and learning from others through interactions, similar to the findings of Wenger (2000). Teachers across the three schools indicated that they learned to improve their PBL teaching through formal and informal professional learning opportunities, support from other teachers, students, administrators, parents, and the broader community. Opfer, Pedder and Lavicza (2011) have also found that teachers’ professional learning occurs individually as well as with others. Overall, teachers expressed that they encountered new experiences in PBL that required them to both seek and provide support, and that the support they received helped them improve their facilitation of PBL.

**Informal learning opportunities**

In terms of support to facilitate PBL in their schools, teachers reported that they received support from a variety of sources that included other teachers, administrators, students, parents, and the extended school community.

**Support from other teachers**

Teachers indicated that they learned from each other through informal meetings where the topics of discussion were practice-related. Barbara recounted a PBL discussion she had with her colleagues on the way home from a school sporting event where they had been coaching.

The five of us went down together in the van and on the way home, we were going to the mall and we were talking about, what’s your project about? What are you doing? And I think we don’t have enough time to do that.

Barbara explained how she supported another teacher with her PBL planning:
I know that one of the Grade 12 teachers was saying that they didn’t have an idea for a project. So I recommended that they don’t do something too big – teachers often think that they need to do a big project. It can be, but it can also be very small.

Beth also recounted how quick, informal meetings in the school hallway with Brad helped her with making practice-related decisions.

I literally would catch Brad in the hallway and be like, oh my god, this just happened today, what do I do about this? Or today was the best day, or whatever, just bombard him with questions.

Brad also discussed how support for PBL from other teachers had grown over the years. He explained that teachers are now seeking his support as they begin implementing PBL into their own practice. He described helping another teacher (Beth) with her PBL planning.

I had an English teacher, she just said, you know what, we’re doing this thing in English and nobody really likes it. Help me figure out what to do. So they dropped everything they were doing and began a project based learning approach to doing something to support First Nations. So that was another positive experience, from another colleague who came to me to help. And I’ve been doing this for about 13 years, each year building it in, making mistakes, begging for forgiveness along the way.

Beth also noted that she found support for her PBL practice in Brad. She also found support from the school librarian, the Academics Head, and a senior school student.

I just loved how Brad was teaching from the beginning, and how he gets it all to flow. He had to start somewhere too, right? So he’s a huge, huge support for me as I have started out with PBL. Also, the librarian from the learning commons is a huge supporter. There was also a senior school student in Grade 12 who is writing on the subject so that was something available to this age group.

Brenda also stated that the librarians and Brad were supportive resources for her in PBL.

I use our librarians a lot. I would go to a colleague as well too. There is always someone to ask, just like the kids – they need an expert to go to. We also go online – Brad is a Twitter master.

Brad was also described by Brenda and Beth as a good resource with technological knowledge. Brenda mentioned sending her own students to Brad for help when she could not help them. She stated, “When I was way out of my element, I had to go see Brad, or I’d send the kids to see him.” Beth said, “I’ve gotten websites from Brad that helped me, with the students,
establish three main things that we want to achieve and I got my rubrics from the Buck Institute [for Education (BIE)], which Brad showed me.”

Brooke explained that both Brad and Barbara had been instrumental in the implementation of PBL in her science program.

I learned about it from Brad and Barbara. She had been to BIE and had done PBL things in her math classes. But mostly I learned from watching Brad. He would say, “You’ve got to try this, you’ve got to try this!” I always said, “Yeah sure! I’ll get the courage!” It took me about three years watching him do this – how is this being implemented? – to get brave enough to try it.

Brooke explained that having the support of Brad and another colleague in the middle school science department was helpful in easing into PBL and that, because they “have the same philosophy,” it makes it easy for the three of them to work together.

Overall, teachers across all three schools indicated that having a supportive teacher to work with helped them in their own teaching.

**Support from administrators**

Teachers at School A reported that they were well-supported in PBL. The teachers expressed that they felt encouraged by administrators to increase PBL at their school. The teachers explained that administration had provided all teachers with books and resources for facilitating PBL and that implementation was still in process throughout the school. The teachers expressed that support from administration was helpful in their efforts to implement cross-curricular PBL. The teachers reported that this was encouraged because “the group that wanted to take it on was so cohesive already.” Alice stated, “Here I find it really easy to integrate things” and Andy said, “I feel supported to try this and to learn from it. It’s okay to make mistakes, then we can make it better.” Alice also stated that she felt supported at her school: “If it doesn’t work, it doesn’t work. We are always supported in our attempts to make learning better.”
At School B, Brooke described how administrative support for PBL had changed over the last few years.

Like, even four years ago, Brad was having a tough time. What if we get parent complaints? It’s a little bit messy. It was hard for admin to get on board initially. Now they see value. Seeing kids engage in it and that PBL is this thing to be embraced. They are giving us the time, the PD, the understanding and also the freedom to pursue it to the fullest. Now they are celebrating the fact that it is messy.

Barbara also explained that a lot of support for PBL has come from administration at her school. She mentioned that, through PBL, teachers and students have developed a direct connection with administration. She noted how direct contact with the Headmaster was valued by the students.

It just made the unit a lot more exciting, a lot more meaningful, and in the end, they felt that they could go to our Headmaster with what they found and educate him on some of the things they found. And then it allowed them, they could understand that it was important to make a graph to have something visible to back up what they were saying.

Beth expressed, “I have huge support from the Head of Academics.” Brad explained that he has “support in terms of leaning on the science budget” and that his “science coordinator and Director of Academics are 100% supportive.” Brad also described how direct contact with the Director of Operations helped support PBL in his classes.

An interesting thing happened with our Director of Operations. So, I would send kids down to him, they would knock on his door, say, “can I talk to you about this – a beehive I want to install, or a box pond? I want to do this, I want to do that.” … So he said, “how about this: any student that thinks they are going to need to install something on our campus that might modify it, change it, or you think there will be any issues, let’s have a meeting time where we get them all together and I’ll go over my basic expectations.” … We went to the common area, about 65 Grade 6s sat there and he had his white board there and he just said, “okay, here’s the criteria: I need to know budget, how much is this going to cost, what is my return on investment, so who is going to use this and how is it going to make the school better. What are my ongoing maintenance costs? Who is going to look after this if you don’t? Where is it going to go? You know, health and safety – what are the issues for health and safety?” … So, he has opened the door, said, “come on in – meet with me. I’ll support you any way I can. If the project is in any way remotely possible, then, yes, we can make it happen.”
Support from administration at School B was also described by teachers as a result of a shift in strategic planning that included the development of PBL across grades and subjects.

Barbara described her involvement in the process.

I was part of a committee that connected to our [strategic] plan. We were tasked with looking at ways to personalize learning. We looked at project based, problem based, inquiry, that kind of thing. We spent a whole year just coming up with definitions about what that might mean and what that might look like and, as silly as it sounds, we took a full year to make an infographic of that, but it takes a long time to do.

Brad also mentioned the strategic plan as instrumental in the growing support for PBL at his school.

So, I think as soon as our strategic plan at the College shifted towards student-centred learning and creating diverse ways to demonstrate your learning, that was key – that they didn’t have to all complete the task – like all write an essay, but you could demonstrate your learning in different ways. So, differentiating instruction, differentiating assessment, and student-centredness [were] all things that added up to me. And I found that encouraging.

Barbara described how this shift in the strategic plan led them to seek support for PBL.

Then we started to look at resources, what are some places in terms of resources that we can tap into? So, we found Buck [Institute for Education]. We kind of investigated them, and we came back and we said, we need to have more teachers doing this process. And the school has been very supportive in terms of partnering with them. Next year we will have twenty teachers in total across the school and we are hoping to meet maybe every six weeks as a group to say, where is your project at? So, part of the thing this year with sending teachers to the Institute is that they have to design a project.

Barbara expressed that she feels that her school is making progress in terms of supporting teachers and students in PBL. She acknowledged that the science department (Brad and Brooke) is one example of teachers supporting each other in the school, and that, through supporting one another, they are helping other teachers learn to do PBL better.

We are making progress, like the science [department], they kind of seem to be the most cohesive group in terms of supporting each other. And we are taking baby steps in math. I think a lot of other subjects have always done projects, but I think they think, I did a project, I’m doing project based learning. And I think giving some more background and context as to what it actually is and what it isn’t would help to kind of dispel that myth.
At School C, Cara and Cathy expressed that they feel supported by administration at their school. Cathy explained that she “sometimes has a TA come in and help when projects get busy” and that when conferencing with students, she receives support from administration which sends a teacher into her class “to do crowd control.” She explained that having extra support in the classroom is “instrumental” in ensuring that she meets with students and provides them with feedback.

**Support from the community**

Teachers across schools reported that they also received support for PBL in their classrooms from the broader community. All teachers across the three schools reported that field trips and community visits were often used to introduce a new unit and generate excitement among students. Annie, Andy, and Alice reported strong parental support for PBL from the school’s parent community and reported using neighbouring parks and community centres as important resources in PBL. At School A, leveraging the parent community helped generate excitement for the PBL work the students were engaged in.

In School B, Beth also reported drawing support from her parent community to help her find international group members for her students. Reaching out to the parents helped her connect with other schools.

I put an email out to the parent community and said, we are looking for schools to connect with across the globe, to do a project together. We ended up with a school in Pennsylvania, one in Texas, two in Mexico and one in Vancouver.

Brad explained that support from the greater community fostered a growing interest in and support for PBL from other teachers over time.

I did get support, I was the one posting it on Twitter and getting the information out to the parents and blogging about it. That’s why I think, this year, when we brought in the experts, that a lot of teachers looked in and said, this is pretty incredible, what you’re
doing. And the level of feedback they got back from professionals saying, you’re on the right track, you’re really doing the right thing.

Brad also indicated that he valued the involvement of the greater community to support PBL in his classes. He noted, “this year, we brought in professional staff and we hosted a biodiversity expo.” Brad shared how he found support for PBL from experts at a local garden.

What we did is, we book-ended the whole project. To kick off the project, we took them for four days to a [public garden] where we immersed them in the biodiversity capital of Canada. We had professional staff facilitate programming for us for those four days. They learned to identify exotic species and experienced the removal of exotic species with actual equipment. We had an herbarium specialist, who was thrilled to bits because she got to do something she always wanted to do, which was to explain to kids the importance of collecting herbarium specimens. So they went on an expedition and learned what it is like to be a botanist in the early explorer days, travelling around unknown land and collecting plants and getting to name them after yourself, so kids did that and came back.

Brenda also found support for PBL in her class through a First Nations community member who met with the students to support them through their PBL projects. She explained, “We had a guest come in who was our First nations contact and who was also part of the 60s scoop.” Some teachers at School B indicated that support for PBL was also provided by a school fund launched by the parent community. The teachers explained that students could apply for a grant from the fund. Beth explained that her students received funding to make orange t-shirts for their project regarding residential schools and reconciliation.

We have an innovation fund, so students can apply for a grant. They got $500 in funding to buy the t-shirts and have them printed. So next year, [the student] will carry this forward and hopefully promote Orange T-shirt Day each year in September.

Brad further explained the fund and how it also supported himself and his students in PBL.

It’s a unique fund because students, teachers, and other faculty can apply for funding a project that will bring joy and innovation to the school. You know, there’s a large amount of money that is doled out each year to support these projects. One of the biodiversity projects this year had a pretty expensive project. When the students went to the Director of Operations about their budget, they said it’s going to be so many thousands for wood and we really want this to create a space to attract hummingbirds and he said you can apply to the fund. So they did and they got the funding for it. … [I]f I went to the science budget or the parents association and make a case for it, I would have a real hard time
competing for phys. ed needs or the basic needs of the college. But because this is a sort of special thing, the parents have contributed to it.

**Support from technology**

Teachers across all three schools expressed that technology was used to support PBL in their classrooms. Teachers sought ways to incorporate technology into PBL and often used videos as a tool to motivate students to initiate their project work. Teachers also indicated that they used YouTube and other online videos to help them learn how to better facilitate collaborative discussions on difficult topics. Technology was also used by teachers to help capture the process of students’ learning during PBL and to help inform assessment. Teachers also explained that they learned from their students’ incorporation of technology in PBL, and that both students and teachers experienced a learning curve in utilizing technology in PBL.

**School A**

In her French class, Annie explained, she and her students used iPads and iMovie for filming their French scripts and, she admitted, “I’m still learning each time.” In Andy’s math class, students used Excel for graphing. While not all students were comfortable with Excel, he explained that some students turned to their group members for assistance when they needed it.

Most of them did computer work. They had the option of doing their graphs in an Excel document if they wanted to or they had the option to use paper and pencil. I think a lot of students wanted to do it in Excel. Some of them knew how to do it and some didn’t know how to do it, but their groups helped with that.

Alice and her students also used iPads, laptops, and simulation games as tools for motivation, research, and presentation. Documents, rubrics, forms, and information about student work was also shared among the PBL teachers to help with efficiency and alignment.
School B

Google Suite – in particular, Google Docs, Google Classroom, Google Forms, and Google Slides – were used by teachers and students at School B for collaboration and communication. Technology also provided Brenda’s students with a virtual collaborative experience rather than a face-to-face collaborative experience. Brad collaborated with his students on their projects across class sections after their field trip to a public garden. Brad explained that he used online platforms to assist in distributing information after their garden visit.

We used Google Docs and Google Classroom to do a collaborative, cross-grade synthesis of what they had learned. They broke up into little teams and made little proposals about what they might do. They all contributed to one giant document, with all the ideas they had generated. I posted it on Google Classroom.

Similarly, Brenda used Google Suite and video capabilities as a means of facilitating collaboration among her Grade 6 students, her school librarian, and her students’ international group members.

Amongst the schools, plus our kids, we had 250 participating kids and we used Google Forms to get them collaborating. When the whole thing came back in a Google Form, that’s where my teacher librarian came into play and she started sorting – going, “these kids have common questions, and these kids have common questions.” Each of our kids had a partner in Mexico and Vancouver, ultimately. They would only communicate through the Google Doc and they would use websites as resources and points of reference. … After they got answers to their questions, they made a Google Slide project that they shared in their own classrooms. They also used video.

Brooke also discussed the role Google Suite played in her ongoing observation and documentation of her students’ work during PBL. She shared her observations of student work that she had recorded on Google Docs with pictures and anecdotal notes. She explained that, during every class, she discusses with the student their contributions to the whole project.

It says so much. Documentation is part of my day. I’m looking for them to generate ideas and follow through. Some kids choose a topic and then move onto another. In Google Drive I set up a folder so they could share everything together. Let’s say if they started
something they were passionate about, there is a shared file with research in it for the next person to use.

She explained that she used her documentation for assessment purposes. She described that, for her, the technology was a “bank of information” used by herself and her students.

Student self-assessments are done in Google Docs. They also submit final products through Google Classroom. They submit slide shows, posters, brochures, online Go-Animate videos. Different things they put together and they are shared with other students. Anything there I can count as work that they have done. Anecdotal notes, pictures – I can’t rely on memory. I need devices like this. I can refer back to this to help reflect on each student and on each project. It helps me note successes and failures and also helps me with report card time. Then I need to come up with a mark – good luck with that, right?

**School C**

Both Cara and Cathy at School C described learning through weekly Skype meetings with other teachers. Cara described how Skype is used to support collaborative learning with her colleagues.

We have a Skype meeting once per week. Every Tuesday morning I make my Skype call to the other campus. It happens during English time because that’s when I can get away. I Skype with four other colleagues. No coordinators there, so we have an agreement and we know in advance that we are going to talk about this, this, and this. We discuss cross-curricular integration with other subject teachers and how to get other teachers involved in each group’s project. It was a necessity in terms of collecting all that data. It has helped me keep track of them.

Cara shared that she gets a lot of support from her technology department when students are using laptops or iPads for their projects. She explained, “I get a lot of support from IT because I’m not good at it and I’ll ask them to come help us with IT and help me and the students, on a regular basis.”

Each of Cara’s and Cathy’s students has access to a laptop and iPad Mini for their projects. Cara explained that the students use these when researching their topics. To help students with their research, a list of preferred online sources and books called a ‘lit guide’ is provided to her and her students by her librarian, who researches the group projects in advance.
She explained that the guide is helpful in directing students to credible research sources, especially for unique topics, and for connecting students with quality French language resources.

**Formal learning opportunities**

In terms of formal learning opportunities, a number of teachers from School B explained that they had received formal professional development from The Buck Institute for Education (BIE). Barbara shared her experience.

I came back from the Buck Institute PD with a project ready for the Grade 7s and basically just presented it to my teaching partner who was like, “sure, that’s great!” So a lot of it had already been done and I think, moving forward, I would like to look at [the] Grade 5 or 6 class and see where we can fit it in or redesign a couple of units around a project.

Barbara found the PD helped her lead her teaching partner through PBL. She reported that the PD provided her with tools that she could immediately implement into her teaching practice.

Barbara mentioned that the school is seeking ways to promote and support PBL more widely in the school. Providing PD for teachers is one way the school is providing support for PBL and helping to implement PBL school-wide. Barbara shared that she hopes that, through their participation in the PD, teachers will align their PBL practice at her school.

And so we are hoping that is something that gets developed and we are also partnering with Buck Institute to go through the process of project based learning, maybe some of the structure behind it to help [the teachers]. … We are hoping to meet maybe every six weeks as a group to say, where is your project at? So part of the thing this year with sending teachers to the institute is that they have to design a project. So we found Buck and we came back and we said we need to have more teachers doing this process and the school has been very supportive in terms of partnering with them and so we are going to hopefully soon have twenty people – but look, you don’t need that to be doing project based learning, but it’s nice to have sort of the same language.

Barbara also stated that PD in PBL has helped her realize PBL differs from the culminating project work that most teachers are familiar with. She referred to projects that take place at the end of a unit as “dessert projects.” Rather than engage students in a project at the end of a unit, in PBL, she explained, “what we’ve kind of done is taken dessert and made it the main course.”
Brad also shared how a PD workshop at a school with a collaborative focus helped him with facilitating PBL in his science classes. He stated that visiting the school and seeing collaboration in action inspired his own practice.

I saw it in action – I saw teachers collaborating, I saw students that were working toward the expectations they were driving toward, I saw the big question being answered in multiple ways. And it really brought home that, yeah, this is the way to go to intrinsically motivate kids for sure, because they were dynamically engaged across curriculum. It was just brilliant.

Another PD opportunity in the form of a workshop was also helpful for Brad. He recalled attending a design thinking workshop that he found meshed well with PBL. For Brad, he was able to apply his experiences in the design thinking workshop to his PBL work in the classroom.

Brad expressed that his experiences in design thinking and PBL practice provided him with a good foundation from which to build further understanding through the BIE PD.

A girl did a really neat design thinking workshop and I loved the design thinking cycle that they presented there and I incorporated that into what I am doing when I set up the early stages of my own project based learning process. And then along came Buck Institute for Education and their online resources for teachers, rubrics and everything is staggering. So, I backwards planned, the most recent biodiversity project into their teacher planning document, post-production but that was super helpful.

Barbara also expressed that she gained a better understanding of PBL from the BIE PD.

At the Buck Institute, they talk about projects, like be careful about your words, like I do projects, therefore I do project based learning. The projects that they call “dessert projects” would [be] like something we used to do. Because you [are] learning everything and then you have this little project that you do to apply what you’ve learned. So, they explain that the project has to be right at the beginning and then it drives everything else. So, that’s what we do.

Cara and Cathy expressed that attending a school-supported International Baccalaureate (IB) professional development (PD) course had been instrumental in their incorporation of PBL into their program.

You are so freaked out when you take this on! I have now done four workshops and they are totally worth it, very relevant. It’s better if you go with a few others, so that, when you come home, you can share more easily when there was a group of you that went. There were people there from a lower-income school too. Their school didn’t have any
money to send other teachers. It’s really cool when you get to attend the workshops and meet people from all over the world and connect through Facebook. We’ve also had people come here to do PD with us as a whole staff, which was really nice.

Cathy described meeting other teachers through IB PD and connecting with them later in their schools. She stated, “I think the thing that is the most helpful is hearing other teachers’ experiences.” She further explained that she found observing other teachers during the facilitation of project based learning helpful in her own practice.

When we first started this, certain teachers took on more than others with the change, so we were really encouraged to go watch other teachers teach. Watching experienced teachers really helps you know what you can bring yourself. One teacher had started it up at her own school. She would go to someone else’s school to help them set up, and then leave once they were rolling.

Cara also shared that PD with the IB coordinator was helpful for reflection and growth in incorporating PBL into her program and how reflecting on projects helped them prepare for the next project.

We have one PD day when we meet with the coordinator and that is once every six weeks and at the end of that meeting we share feedback from the last project. We learn from that and prep for the next one. So we’ve been tweaking this for years.

Overall, teachers from each school indicated that they received support from a variety of sources and that, through formal and informal learning opportunities, technology, and support from other teachers, administrators, parents, and the greater school community, both students and teachers are learning.

3. Learning through the unexpected in PBL

Interviews with the teachers revealed that they encountered a variety of challenges while facilitating project based learning. Teachers described shifting more control to the students in PBL as very challenging as it often led to unexpected outcomes. This is not surprising since, as stated previously, facilitating PBL has been described as difficult for some teachers (Darling-Hammond et al., 2008; Levy & Shriki, 2008; Zhou, 2012). Interview responses also indicated that
teachers struggled with assessment in PBL. Teachers also expressed that having little time to meet with other teachers regarding PBL and insufficient teaching time with students contributed to challenges in PBL facilitation. Overall, teachers reported that they are motivated to work through the unexpected challenges in PBL for the benefit of their students.

**Student-centred learning**

Across the three schools, teachers reported that facilitating PBL required a move away from a teacher-directed classroom to a student-centred classroom. Teachers at each school described this shift as challenging, which connects back to Borko and Putnam’s (1996) assertion that teacher practice is deeply rooted in teachers’ individual beliefs and experiences. Given that facilitating PBL differed from teachers’ own experiences as students, teachers reported feeling uncomfortable with giving more control to the students and reported that, in facilitating PBL, they worried that they were losing control of their class and of their curriculum. As mentioned in Chapter 2, other researchers have found that teachers’ beliefs affect how they implement new programs and scaffold learning (Fullan, 2007; Grant, 2011; Krajcik et al., 1998) and also impact the design and implementation of PBL (Krajcik, Blumenfeld, Marx, & Soloway, 1994). Although challenging at times, teachers at each school described that, through PBL, they had learned to provide students with greater control and to approach their curricular goals differently than they had done prior to facilitating PBL.

**School A**

Teachers at School A reported that, in facilitating PBL, they found it challenging to move their teaching practice from teacher-directed to student-centred. Annie described that “letting-go” during PBL in her French classes involves experience and an understanding of how to create learning opportunities for students.
I find it scary just to sit back and go, “you’re in your groups, talk amongst yourselves.” I find that really hard as a teacher. And that’s something I think, over twelve years, I’ve gotten better at stepping back, because when you step back really neat things happen. But if you are [a] helicopter teacher who’s on top of them for everything, you don’t have those moments of, “oh, maybe we can do this, or go in this direction.” It’s challenging to step back. I think with this type of learning there is so much more potential for them to learn and to learn how to learn.

Alice shared this perspective. For Alice, PBL provided students with the opportunity to explore their own interests. She stated, “I don’t want to impose structure on them.” Alice further explained her perspective on giving more control to the students in PBL even though it’s challenging for her to do.

I really liked projects as a kid, and I wanted to give as much self-direction to the kids as possible. There are times when it looks like chaos in here. It would be loud, people are moving and doing lots of different things. Like people are on the floor doing art work, some people would be in the hall on a computer working on a video. It’s not like a class where you look forward. The whole program here evolved from teacher-directed to if-you-want-to-do-it-you-can-do-it. The PBL ideal is that you have to be flexible and that means you have to let go.

Alice also explained that, while she finds it challenging to shift control to the students, she finds that support from administration has helped her do so. She expressed, “I feel 100% supported to teach project based learning and give more and more control to the students.”

Andy also explained that, despite having experience with implementing PBL into his math class and having done a lot of “explorative learning” where “students explore different concepts in groups before we go over it in a class,” he worries about his role as a “mediator” and whether or not his students are successful in achieving curricular goals through PBL.

So, one of the challenges I worry about is that they will have trouble choosing the right type of graph for their PBL and they won’t know how to graph it. It’s explorative and they are supposed to be looking into it themselves and me being a mediator – that’s a challenge I’m kind of worried about. Also, the group work, obviously – because they are working in a group, I’m worried that one might do more or less.

He also noted that he felt worried about covering the math curriculum in PBL.
With the amount of things that I am asked to cover in the curriculum, I find integrating PBL a challenge because you can only do so much.

**School B**

Teachers at School B also shared the perspective of shifting control in PBL as a significant challenge. Brooke explained that, initially, she was unsure of PBL and how to adjust to a shift of control from teacher-directed to student-centred. She explained that she felt this was a common challenge for teachers. She expressed, “I think, for the most part, teachers want some control.” Brooke explained that she has had to “ease herself and the students into PBL.” She described how she designed her science units to help her through the transition.

The first unit was totally teacher-directed. The second unit was more of an in-between: teacher directed, but student choice. For the flight unit and the structures unit, there are 14 tasks [and] they have to do 6. The tasks are all on the bulletin board and the students have the choice. There are some we do together as a group – [those tasks] are the ones that check off the curriculum the best and give [the students] background information. So now, for the final unit, it’s totally student choice. Then I ask them what unit they liked the best and why.

Brenda explained, “I’ve learned to let go, you really have to let go. Letting go is the hardest part. It’s incredibly scary.” She recalled looking in at Brad’s classes and being intrigued by the “energy and chaos in the classroom.” She explained that “letting go” in teaching does not come naturally for her, but that she feels working collaboratively with Brad has been helpful for her.

But where you have the benefit of – Brad is so laid back, and I am so type-A. I’m a flexible type-A, so when he gets a little flakey on me, I’m like, “Brad!” He will always be the driving force behind letting the kids go, and so that’s – it’s super, super important. I think I’ll be the one creating frameworks for my own inner angst, and he’ll go, “yeah, that’s okay!”

Barbara explained that, by giving more control to the students, she has had to learn to find creative ways to cover her math curriculum, which she described as “a little bit of a risk.”

So it makes it a little bit tricky because you know what you have to hit. You have to be open and get them to experience it and learn it, but I have to get through this, and so how
do I do that? I think just being able to take a little bit of a risk and to be creative, that is a bit of a challenge, as well.

Brad explained that he has learned through the challenge of shifting control to his students.

Not only do you have to let go of the curriculum temporarily, let go of the delivery of it, but you also have to let go of the process and there’s a big trust with the kids too. That process, for me – learning – is that whole getting on the side of the kids and saying, “You know what, (1) I don’t know, let’s learn together and (2) I don’t know where this is going, and I’m going to let go of it totally and this is going [to] take way longer than I thought, and I’m going to let go and I will help you.”

Brenda explained that as you shift control to the students, “you can feel that you are losing control of what students research and the topics they choose to pursue,” which can be “uncomfortable.”

Right now, with the Grade 8s too, we are doing these mini documentaries. Come up with any debatable issue. Some students are doing something as simple as, why should we have school uniforms? And some kids are doing something more racy, like what do we do with the legalization of marijuana?

For Brenda, she asserted that “engagement is huge” which is why she felt it was important to provide her students with the opportunity to pursue what interests them and to “feel responsible for their learning.” For Brenda, providing students with the opportunity to make connections on their own was important. Like Alice in School A, although she admitted that she finds it challenging to “let her students go,” Brenda expressed that it is necessary for student-centred learning. She explained, “we need to let them write and see what they don’t know how to do instead of teaching what we think they should know how to do.” In planning for the following school year, Brenda explained that, despite her discomfort with letting go, she plans to continue to do so with Brad’s help, which suggests a high level of collective-efficacy (Bandura, 1997) between Brenda and Brad. She stated, “Brad and I have to talk about it before we jump forward in the fall, but we really want to let them just go.”
School C

At School C, Cara and Cathy also shared that they learned through the challenge of shifting control to the students in PBL. Cathy explained that, once they have launched the projects, students work independently, which “makes them very independent and helps them develop big skills, work habits, and learn how to work in a group,” but that she still has to “navigate with them,” which she has found difficult.

There is so much more rolling with the punches than before. I had this group once that went off and came up with 76 questions and I had to figure out how to make the questions link to the curriculum. I didn’t want to discourage them. I wanted to make time for them, but it was difficult. I hope that I am always improving on stepping back from what the students are doing, but letting go is a challenge. So, again, that’s something that I like to get out of PBL for myself. Honing my own skills.

Cara expressed, “At first I was so uncomfortable at times, it’s such a learning process.” She explained that she would feel more comfortable with shifting the control to the students if she didn’t have so much curriculum to cover.

If I only had one unit, I would feel better, but I am being asked to make sure that I am doing the French curriculum, the Ontario curriculum, and the IB unit – and it’s a lot to be on our plate.

Planning and instruction time

Teachers at each school expressed the need for more meeting time for PBL and cross-curricular planning. At each school, interviews with teachers indicated that insufficient time with other teachers and students contributed to challenges in facilitating PBL.

School A

At School A, Andy, Alice, and Annie each acknowledged that working within a timeline was challenging. Planning for their cross-curricular project had taken place during lunch hours and prep times. Occasionally, a meeting time for PBL took the place of a department meeting.
Alice explained that the PBL projects became easier from year to year and that they learned to become efficient in their communication and planning.

Starting from the beginning and discussing as a group how we were going to use all of our skills and our minds – starting positively from the beginning, it set a positive tone, we just had to stick to our goal.

Annie explained that email was useful in planning but that more face-to-face time would have helped to improve the PBL process from onset to completion.

**School B**

Barbara reported that time was a challenge in facilitating PBL. She explained that, as part of a response to this challenge, the school had taken steps toward making an adjustment to the timetable.

We are looking to redesign our timetable and, in that, there [is] supposed to be more time for teachers to meet. So, hopefully that’s the case, because right now there really isn’t. And, you know, it’s really difficult, because I coach in the fall. Someone might coach in the winter and right now – well, in the winter my activity days were Monday, Thursday and my teaching partner was Monday, Tuesday, Wednesday and so there is no after school day we can meet except Friday and no one’s going to want to meet on a Friday. And then, in the early morning, it can be very difficult.

Barbara also indicated that PBL is time-consuming and takes longer than other teaching approaches. Despite this challenge, she stated that dedicating more time to PBL is worthwhile if it means that students are benefitting.

Having time is a challenge. It’s also the balance between getting through x, y, and z. I can get through that in a week, but I get through it in a month teaching it this way. That is a real piece that people are concerned about – you know it’s going to take me too long. I mean, I’m not going to lie – it does take longer. It’s not a bad thing but it’s something that is difficult for teachers. I mean, the hope is that they have a better understanding and a longer-lasting understanding because they’ve had a personal connection. I mean, I don’t have proof of that – we didn’t do a pre-test and a post-test – but the hope is that, because it was personally connected to them, they know what they were doing, why they were doing it – that they are going to remember it, you know, as opposed to something they are just memorizing.
She also expressed concern about finding more time to dedicate to PBL and wondered how teachers are meeting the challenge of time at other schools. She recalled attending a math conference and having conversations with teachers from other schools. She shared her thoughts on her time commitments at her own school.

I just came back from a math conference and was like, “I have all these great ideas!” And, as you think about it, we’re, as an independent school, for the most part, not every day, but most days here until 4:45 pm for activities and things. … Then you’ve got marking and then there are also other pulls for your time – it’s not just the curriculum but it’s this new thing that you have to wrap your head around. So you’re pulled in a lot of directions. So I don’t have an answer – I’m kind of like, “let’s pick one thing and focus on it for a little while and do that really well.” But that doesn’t happen by nature – there are just too many things on the plate and that’s the way it is.

Barbara explained further that she has an interest in providing more cross-curricular opportunities for her students, but is worried about how teachers would find time to collaborate. She suggested that the new timetable might help with facilitating collaborative opportunities for her and other teachers. In the meantime, she shared that she feels she is learning how to fit in meetings and PBL planning as she goes.

So, you just have to kind of figure it out on your own and hopefully with this new timetable we will have more time not just to do projects, but to sit down and discuss what’s going on.

Beth also indicated that a new schedule would help provide teachers with planning time with other teachers. Like Barbara, she explained that her involvement in the school leaves little time for additional teacher meetings for PBL.

“We run, run, run, run, run. I mean, if we are all here until 5:00 or past, and then doing after school activities, then it doesn’t leave much time for that. Hopefully, our new schedule will help with that.”

Brooke also discussed further details of the upcoming timetable change.

We are changing the timetable next year to incorporate more cross-curricular projects. So next year, there won’t be just a science project – like a Grade 7 project that incorporates all of the subjects. I’m not sure how long – 300 minutes total teaching time with flex time at the end of the day to tie up loose ends, collaborate. So we are going to an 8-day schedule and then the projects will be built into all of the subjects.
Brad also reported that he does not have enough time to initiate more cross-curricular collaboration with other teachers. He shared that he would do it on his own, but that, having tried that, he feels “it’s impossible to manage in the way you would hope.”

I would love to do more cross-curricular collaboration, but I don’t have time to fit it in with what I’m doing in my regular course. Lack of meeting time made it difficult to encourage collaboration across subjects. Teachers weren’t really sure what they were contributing to overall. They just kind of thought, “well, I’m helping out science.”

Brooke expressed that more meeting time would be required for further cross-curricular integration.

If I am going to get together with all of these departments, we need time to meet. Who organizes that? We need time built into our timetable to talk cross-grade and cross-subject. That would be great so that I can focus on the science part and the English teacher can focus on the written part – or maybe, in art, composition of the presentation. We need admin on board for that. We need release time to meet with the other teachers you want to work with. … It was easier to incorporate this within our department, but outside of the department would be very challenging. Flex time might be a time for the students to be in an organized event so that teachers can also meet.

Brenda also asserted that time was an important factor in terms of learning to do PBL better.

So, to do these things really well and to do them better, I think that time is really important. Like, if we had more than English class to work on these projects, and if I could have had three English classes all together, they would be so much more ahead. So time is definitely the hardest. Having time to debrief is huge and I need to do a better job of building that in next time.

She also stated that more planning time with other like-minded teachers would help her in her practice.

So, overall, I think we need to have time to really take the students there, but also time for us to focus on them getting there. But just to be able to get a group of like-minded people together – like teachers that are doing this together. To be able to download and talk about things, like, “oh, we should have done this,” or “oh, that happened to me before,” you know. We don’t have the time.

Brad recalled having more time allocated to meetings and other commitments when he was a science coordinator. He shared that he finds he needs that time more now in PBL.
Disappointingly, when I was science coordinator, I had release time to budget, to plan, and meet and visit classrooms. But we never once over multiple years met as a team of instructional leaders across subjects, which I think was a failing of the whole process, because we never got to share what we were doing and look for opportunities to collaborate and do things like that. It was just never a priority, never valued, and never supported by administration at that time. And I think they’ve realized and they’re starting to do that now more and I have a lot more conversations. With PBL, we need that time back.

Brenda shared that she and Brad received release time earlier in the year to plan some cross-curricular work for the following school year. She explained how they have begun to address the challenge of time together and their hope that the new timetable will help them in the future.

We just had a huge brainstorming session with, “okay, where do we start?” with chart paper. And we were looking at his program, my program, and trying to see where there were natural connections. And then we said, “okay, let’s look at all our skills.” I mean, I evaluate them for presentation skills and he evaluates them on presentation skills, so we said, “why don’t we evaluate them once for presentation skills?” So we listed all the skills on the page. And so we are going to use that – we know we have to come back again. And, after three hours, we had this big chart paper mess kind of thing. And then we had our concerns down the side and that’s where we are at the stage right now where timetabling is the biggest issue.

**School C**

At School C, Cara explained that a significant amount of PBL planning took place during her own time. While meeting times have been scheduled for her and Cathy to plan together, it is never enough time.

In terms of meeting with Cathy, which is so important because the units are bilingual, we are lucky if we meet one prep a week. But I don’t get it – we email, phone call, “where are you at?” Even if it’s just a plan like, “do this period 3 and I’ll come and help you.” Cara shared that she is often in Cathy’s classroom during her prep time to see what the students are working on and to have a chance to meet with Cathy, but that Cathy’s schedule doesn’t work for her to do the same.

I usually try to stay in her classes to help, but she cannot because of her work load. She has two other classes, so it’s very difficult. So, not only am I in my own class, I’m in the
other classes too. I choose to do that so that I can see the whole picture and make sure it’s matching up.

Cara went on to explain how she seeks alignment with teachers other than Cathy, as well.

I am also constantly meeting with the phys. ed teacher and music [teacher] because I am trying to string everything together. “Can you do this for our project? Can you put this in the musical?” There is no support to plan out what can be done in music. It has never been done, but it should. We never meet formally. I think that would have to be initiated by the principal, and right now the principals are saying, “you initiate it, meet in your own time.”

Like Barbara in School B, Cara also explained that she was very busy with multiple commitments in her school.

In independent schools we are asked to do a lot of extra-curriculars, do communication, do coaching, and this year, also, for us, the mentoring. It’s a lot and it means long days.

Despite these challenges, teachers perceived PBL as an opportunity for students to engage in meaningful learning with many potential gains. Teacher participants across all three schools expressed that they had a passion for PBL despite the challenges that PBL presented for them, but they felt that more time allocated to planning, meeting, and reflecting would help them strengthen the PBL opportunities they provide for their students.

**Summary**

The teachers reported that they learn through collaborating with their students and with other teachers within the context of PBL. Teachers also reported that cross-curricular planning with other teachers contributed to their knowledge of student topics and understanding of PBL design, facilitation, and assessment. Teachers also reported that, in facilitating PBL with their students, they have further developed teaching skills that are important for student development. Overall, teachers expressed that teaching PBL was a learning experience for their students as well as for themselves.
Teachers also expressed that they require and value a variety of supports that include colleagues and teachers, administrators, students, parents, and the extended school community. Teachers working together in PBL expressed that, while they are providing support, they are also receiving support. Interviews with the teachers also revealed that they seek support through formal and informal learning opportunities and that they value time spent with their colleagues discussing and planning PBL.

All teachers in this study indicated that they encounter a variety of challenges and unexpected outcomes in facilitating PBL and that, through teaching PBL, they have learned to self-identify areas in which to seek further professional learning. Teachers expressed difficulty with shifting from a teacher-directed to student-centred approach in the classroom, as it required them to relinquish control. Teacher also reported it was important to continue to find time to meet with other teachers to collaborate in PBL. Overall, teachers expressed a passion for PBL. Teachers also expressed that knowing the gains students make in PBL makes PBL necessary to pursue and equally necessary to support.
Chapter 5: Discussion and Conclusions

In this chapter, the findings presented in Chapter 4 will be considered in relation to the conceptual framework introduced in Chapter 2. Some limitations of the study, as well as implications for research and practice, will be presented.

Discussion

The purpose of this study was to investigate elementary school teachers of various subject areas involved in PBL to gain an understanding of teachers’ perspectives about learning through collaborative experiences in PBL and to better understand what and how they learn in PBL both from and with other teachers and from and with their students. From the teacher interviews, three major categories emerged: 1. Learning from experience in PBL; 2. Learning through support in PBL; and 3. Learning through the unexpected in PBL.

Overall, teachers reported learning through collaboration and through cross-curricular integration both with other teachers and their students. Teachers reported that technology is particularly useful for supporting collaboration and aiding in learning. Teachers reported that, through facilitating PBL, they learned scaffolding techniques that helped them improve their facilitation of PBL and also benefitted student learning. Teachers also stated that both formal and informal learning opportunities relating to PBL contributed to their ongoing learning and helped them meet the needs of their students.

Teachers also shared that they seek support from other teachers and that they value collaborating with their colleagues throughout PBL. Teachers reported that they learned from other teachers through informal meetings, discussion, and time spent with their colleagues and
that they seek ways to learn from their colleagues when facilitating PBL. In addition to the support of other teachers, participants also expressed that they rely on and value support from administration, students, parents, and the broader school community.

All teachers in this study also indicated that they encounter a variety of significant challenges in facilitating PBL, and that through their experience facilitating PBL, they have learned to identify areas in which to seek further learning and development. Teachers across all three schools also reported that learning to facilitate PBL required a shift of control from a teacher-directed classroom to a student-centred classroom and that this shift in control involved a series of challenging adjustments. Teachers also reported that they have experienced difficulty when assessing students in PBL, but, through their experience facilitating PBL and through the support of other teachers and administrators, they have learned to adapt their assessment practices to focus on their students’ processes of learning rather than their final products alone. Other challenges described by teachers included a need for formally scheduled meeting times for teachers to collaborate, clearly articulated assessment guidelines that align with PBL, and more feedback that acknowledges teacher impact throughout the PBL process.

**Communities of Practice**

Across the three schools, teacher participants collaborated with other teachers. Teachers reported that they felt supported by other teachers who were also engaged in PBL at their school. At each of the three schools, teachers expressed a shared passion for PBL and stated that they were learning from each other to improve their facilitation of PBL. In particular, teachers at School B described developing a “shared language” through their experience in PBL that they hoped to strengthen through further formal professional learning experiences. Wenger describes teachers who have a collective understanding, mutual engagement, and a shared repertoire
through collaborative experience as members of a Community of Practice (CoP) (Wenger, 2000). Individuals who collaborate to produce and implement projects draw on Wenger’s notion of situated learning (Lave & Wenger, 1991).

While a CoP was evident at each school, characteristics varied from school to school. In particular, at School A, the three teacher participants worked collaboratively to facilitate a cross-curricular project. Teachers reported that they collaborated on their own time, shared resources, and initiated common documentation practices of PBL work which demonstrated a commitment to each other as well as the success of the learners as a whole.

School B had a slightly larger CoP consisting of but not limited to 5 teacher participants. The interview data indicated that the science department teachers were prominent contributors to the CoP, with Brad reported as the perceived leader. Brad had also demonstrated flexibility with working outside of the CoP. Through fostering a connection with the Director of Operations and other community experts, he established a means to access funding to further enhance learning experiences not just for his students, but for other teachers as well.

School C had a CoP which the two teacher participants were part of. They worked collaboratively to facilitate both English and French aspects of students’ bilingual projects. They represented a smaller section of a larger CoP that included teachers at another school campus. They would Skype with the other members of their CoP to reflect on completed projects and plan future projects.

Each teacher participant was an active, competent member of a CoP at their school. CoPs are helpful in explaining the dynamic role of each of these teachers as both learners in and facilitators of collaborative experiences. Teachers at each school demonstrated a desire to lead
new learning as well as to adopt new learning for the benefit of their facilitation of PBL. Leading to learn can be described as an example of “professional capital,” that is, when groups of teachers work together in a school, student learning increases (Fullan, 2014). Through their commitment to their CoP, each teacher demonstrated leadership and a desire to lead learning in their school.

**Teachers’ Learning Processes**

**Beliefs and attitudes**

Overall, teacher participants across the three schools demonstrated and described an enthusiasm for facilitating PBL. All teachers expressed a desire to seek and share new learning both from and with other teachers and also from and with their students. Teachers reported that PBL required a shift in their perspective of teaching practice from that of a teacher who is directing learning to that of a learner who is leading learning. Across the three schools, all teacher participants reported that they have learned through their experience in facilitating PBL.

All ten teachers in this study expressed a strong interest in student engagement which stemmed from a belief that, if students are engaged, they are more likely to learn throughout the project and sustain engagement to project completion. Participants across the three schools reported that PBL is more engaging for both students and teachers than more traditional forms of teaching. Teacher beliefs have also been referred to as “one’s orientation toward teaching” (Park et al., 2011), which can influence the way in which a teacher will implement teaching models (Borko & Putnam, 1996). Overall, the interviews with the teachers suggest that teachers’ beliefs play an important role in how PBL is facilitated and that teachers engage students in PBL by learning to reduce direct instruction where appropriate and increasing their own interaction with the students during their learning. Overall, participants expressed the belief that assuming a
supportive role in their classroom practice was integral to implementing PBL across grades and subjects.

Across the schools, the math teachers expressed that PBL was challenging to incorporate into all math units. All three math teachers selected data management as their unit of focus for PBL. Andy, Barbara, and Cara each stated that, while it is important for students to engage in explorative learning and inquiry in mathematics, it is also important to include some direct instruction to ensure students have the skills they need to be successful in their PBL work. Barbara’s plans to incorporate a variety of teaching methods into her math program indicated that she considers diverse approaches for student learning. In addition, the math teachers expressed that it is important to provide contextual math problems that students can self-direct themselves through.

Barbara felt that her students’ uniform survey was engaging for students since the data they generated and presented to the Headmaster had the potential to impact the school. Some research suggests that teacher beliefs about how students engage in mathematical activity and learn plays an important role in how inquiry based learning and PBL is designed and implemented (Lloyd, 2002). The math teachers’ beliefs about teaching math are demonstrated in their PBL implementation as well as their dedication to instruction and student engagement. Barbara also stated that it was important to her that her students met specific curricular goals. She was not only satisfied that the students had learned to generate data for a real-life problem, she was also satisfied that her students had learned that a graph is an effective means of illustrating data for an audience. PBL is an effective approach for students’ application of curricular understanding (Swartz & McGuinness, 2014).
In this study, teachers across the three schools also expressed the importance of pursuing PBL topics they valued. Alice expressed that her personal experience with projects as a young student influenced her beliefs about PBL as a teaching method and her desire to provide her students with project experiences through PBL. She stressed the importance of pursuing topics that were of the teachers’ interest in order to generate authentic enthusiasm for learning in her classroom. Beth also explained that both she and her students “were inspired” to pursue research on residential schools and reconciliation. Cara’s passion for social justice and sharing others’ perspectives also played a role in her facilitation of PBL in her class. As it is known that teachers’ values are representative of “not just what a teacher thinks to be true about teaching and learning, but what they would give high priority to in their own practice” (Opfer et al., 2017, dp. 444), teachers’ incorporation of topics they felt passionate about is indicative that the teachers in this study model authentic learning engagement (Kuhn, 2015). Further research in PBL might provide insight into how teacher and student learning relates to what teachers believe and what they place importance on.

**Classroom practice**

Overall, interviews with the ten teacher participants indicated that PBL was an engaging experience for themselves and their students. PBL involves a collaborative, student-centred approach where teachers and students work together to plan and learn (Mitchell et al., 2009). Teachers described how their role in the classroom changed through facilitating PBL. Teachers reported that facilitating PBL required a shift in their classroom practice from teacher-directed to student-centred, which involved a series of challenges. Research suggests that teachers are resistant to implementing project based teaching methods in exchange for more traditional teaching approaches (Borko & Putnam, 1996) and that teacher learning occurs within a variety of
instances throughout a teacher’s daily work (Borko, 2004). It is, therefore, not surprising that some participants reported it took years for them to shift their classroom practice.

Teachers also reported that they perceived their shift in practice to that of a “mediator”, “facilitator” or “coach” in PBL, in which they “got on the side of learning with the students.” Kuhn (2016) has also described teachers who work collaboratively with their students as “facilitators of accountable talk” (p. 146). As a collaborative approach to learning and teaching, PBL requires teachers to play a supportive role in the development of each student’s project focus (Hmelo-Silver, 2006). Teachers who work collaboratively both learn from others and support the learning of others (Richardson & Placier, 2001), which provides an explanation as to why participants reported they have changed their practice through their collaboration with and observation of other teachers in PBL.

While each teacher in the study indicated that their role in the classroom has changed through teaching PBL, there were some differences in teachers’ ability to adjust to their role in PBL that may have stemmed from their own personal beliefs about teaching. As teacher learning involves a struggle as to whether to accept or reject new learning (Timperley, 2007), teachers’ beliefs and values play an important role in whether or not teachers adapt their practice over time. Teachers across the three schools had clearly embraced PBL and were seeking support from a variety of sources to continue to learn to make it better for themselves and their students. This process describes how teacher learning is linked to teaching practice and how teachers’ beliefs and values play an important role in whether or not teachers adapt their practice over time.
Knowledge and skills

Across all three schools, teachers expressed that they further developed the knowledge and skills required to facilitate PBL through experiencing PBL facilitation, and that they sought out opportunities to learn the skills required to facilitate PBL. All participants indicated that, through their experience facilitating PBL, they have learned to balance PBL with direct instruction.

Teachers also reported that through PBL they learned to identify scaffolding opportunities for students and became more confident in scaffolding experiences through PBL for their students. In facilitating PBL, the teachers learned to better differentiate and scaffold learning opportunities for others, and provide support for their students and their colleagues. Teachers also reported that they learned to scaffold more effectively for students through PBL as working collaboratively with their students in PBL helped them understand their students’ individual interests and learning styles.

Overall, teachers reported that support for PBL in their schools helped them acquire the knowledge and skills necessary for facilitating PBL. Interview data and observations in this study suggested that teachers’ learning within the context of PBL emphasized teachers’ expertise rather than other aspects of teachers’ knowledge.

Experience

Teachers across all three schools commented on their level of teaching experience and referenced it as a factor in successful facilitation of PBL in their subject area. According to Good and Brophy (1986), the success of PBL rests on the skills and knowledge of the teachers facilitating this form of teaching and learning. Experience was believed by all teachers to be an important factor for successful PBL facilitation. According to Bruner (1996), knowledge and
new understanding are constructed by the learner, whether a student or a teacher, through social experiences. Annie mentioned that, through many years of “stepping back”, she has improved at facilitating more student-centred and student-driven collaborative learning experiences in PBL. Alice expressed that, through her experience working collaboratively with her students in PBL, she has learned to focus more on the process than on the product and more on student learning than on scheduling, which is in line with current Ministry guidelines (Growing Success, 2011).

For Andy, experiencing PBL in his subject area was viewed as a learning experience and he indicated that he reflects on his teaching practice to inform future teaching experiences. He expressed that his experiences facilitating PBL have the potential to affect how he teaches in the future. This is important, as teachers facilitating PBL should regularly reflect on the PBL process from their perspective (Lavy & Shriki, 2008), because it is known that this process supports and engages personal development (Cooney & Krainer, 1996).

Brenda and Brooke both expressed that they were still learning to embrace PBL. They reported that they learned to facilitate PBL through observing and working collaboratively with Brad. They both described feeling uncomfortable about PBL at first, but that they became interested in implementing PBL in their own subjects when they observed the high level of student engagement in Brad’s classes. Self-described as “Type A”, Brenda did not feel that she identified with Brad’s approach to teaching and learning. Through her experience working with Brad on project aspects where she could provide support in her area of expertise, she discovered ways she could personally contribute to PBL and reported that she gained a level of comfort around the facilitation of PBL. Kuhn et al. (2016) assert that when one recognizes a purpose for new knowledge, it becomes valued, and when used, the knowledge then becomes owned by the learner. Learning through collaborative experiences like Brenda and Brooke did has been
described by Kuhn (2016) as a process in which learners are “taking ownership of knowledge” (p. 144). For Brenda, learning that she had knowledge that could be used in PBL gave her ownership of her knowledge.

Across the three schools, teachers reported that, through their experience teaching PBL, they learned to improve their facilitation of PBL. Teachers who know a multitude of ways of learning and teaching so that they are able to model a variety of ways of learning themselves have been described by Hattie as “adaptive learning experts” (Hattie, 2012) and as “engaged learners” who “possess a very flexible and broad repertoire of professional learning practices in line with their values” (Pedder & Opfer, 2013, p. 17). Teachers in this study reported that they had support to facilitate PBL, which further suggests that in addition to becoming “adaptive learning experts” they are also “engaged learners.”

**Scaffolding in project based learning**

It is strongly recommended that teachers incorporate appropriate scaffolding throughout the PBL process to assist students in overcoming challenges and to better support students’ learning experiences (Lavy & Shriki, 2008). The process of supporting tasks that are difficult for a learner to achieve independently is described as scaffolding (Wood, Bruner, & Ross, 1976). The teachers interviewed reported that they increased their skill in using scaffolding techniques through facilitating PBL. Scaffolding can occur among students, between students and teachers, and also among teachers. Facilitating learning experiences through PBL involves skillful teaching. Lack of knowledge surrounding PBL and learning could result in improper scaffolding, assessment, and redirection as projects unfold (Darling-Hammond et al., 2008).

At the beginning of the PBL process at School A, Annie helped facilitate a discussion that encouraged students to make suggestions about their scenario for their script. Through
providing the opportunity for the students to first think individually about their ideas and then to share their ideas as a group, Annie helped scaffold a decision-making process and ultimately helped the students focus their ideas. This also provided Annie with a good understanding of student topics and with knowledge of the process by which students arrived at their topics. Facilitating classroom discussion provides support for both students and teachers and also serves as a scaffolding tool since during discussion there is a focus on developing ideas and developing an understanding for student topics (Lavy & Shriki, 2008).

In School B, Beth also helped facilitate discussion and engagement among her students in PBL. She acknowledged variation in her students’ task-initiation and ability to self-direct. In response to this, Beth engaged in frequent discussion and encouragement with her less-motivated students and expressed the importance of scaffolding concepts for those who need it. She intentionally paired less-motivated groups with more-motivated groups to help facilitate student collaboration and identify ways projects could overlap. This was also the case with Brooke, who encouraged a lower-output group to contribute to a project that was already established. Similarly, Brad also indicated that, to scaffold their learning, he would help connect students with other experts in the school who could help them achieve their project goals.

Scaffolding students’ learning involves skillful attention from teachers. In School C, Cara and Cathy expressed that in their experience with PBL they have learned how to facilitate collaboration among their students so that everyone is a contributor. Cathy stressed the importance of teachers’ curricular knowledge in order to provide appropriate scaffolding opportunities for students.

When students are working together they learn from one another. In seeking ways for students to scaffold learning for other students, teachers shifted the teaching away from
themselves to the students. The social interaction that occurs through this experience promotes learning and understanding (Vygotsky, 1978).

**Learning through Collaboration**

Working collaboratively was described as beneficial not only for student learning, but also for teachers. Across the schools, it was evident that the teachers in each CoP were using their individual expertise for the benefit of the group. Buchanan and Badham (1999) have used the term “bricoleurs” to describe those who assemble and utilize diverse skills as resources in order to accomplish a goal (Ryan, 2010).

At School A, each teacher brought subject-specific expertise to help their students in their cross-curricular project. At School B, teachers also collaborated to assist their students with English expertise that was essential to the writing components of the science projects. At School C, both teachers’ French and English expertise was essential for their students’ bilingual PBL work. Collaborative experiences provide an opportunity to take advantage of individuals’ strengths, which promotes interdependence not just within a group, but also across an organization and may lead to an increase in self-determination and improved experiences (Leithwood et al., 2004) as well as improved optimism and increased engagement (Bandura, 2000; Fullan, 2014; Mascall et al., 2009). Teachers at each school described that collaborating with other teachers and using their strengths motivated them and contributed to their sense of feeling supported by other teachers.

Across the three schools, participants also expressed that working collaboratively was engaging and more productive than working alone. While teachers at each school supported collaborative learning, they also acknowledged the potential challenges that collaborative learning presents to students and expressed concerns about their students working in groups.
They also expressed an appreciation for the social learning that occurs through group collaboration and a dedication to creating meaningful learning opportunities for their students.

Annie, for example, found that teaching cross-curriculatively helped her students produce higher quality work than when teaching her students on her own. Beth, Brenda, and Brooke reported they increased their own engagement in PBL through working collaboratively with Brad. In working collaboratively with Cathy, Cara reported that she became more engaged in her students’ work and attended her students’ English classes on her own time in order to gain a greater understanding of their project work. Timperley (2007) has emphasized that when teachers work collaboratively, they also develop professionally, which plays an important role in teachers’ commitment to practice (Hattie, 2012).

**School Support**

Support of school leaders so that teachers can affect their students in positive ways requires maintaining a commitment to teacher support (Hattie, 2012). Across the three schools, teachers reported that they felt supported to pursue PBL. Andy mentioned that he felt supported to make mistakes. Alice mentioned that she felt fully supported by her school administrators. Knowing that teachers maintaining a commitment to teaching is affected by the support of school leaders (Hattie, 2012), part of the participants’ dedication to PBL and ongoing learning may have been due to their perceived support from administrators.

Participants in this study reported receiving support at each of their schools. Teachers reported receiving professional learning opportunities, additional teaching staff when required, scheduled release time for collaborative meetings, and positive feedback on their efforts in PBL, which may have contributed to their dedication to PBL since ongoing learning is known to be dependent on a broad range of factors including perceived support (Hattie, 2012).
Teachers’ professional learning

Teachers in this study reported that they learn both from and with other teachers and also from and with their students through collaborative learning experiences in PBL. Teachers also expressed that in addition to learning collaboratively, they seek new learning alone and that they consult a variety of resources for support in PBL that is driven by their own interests. Teachers reported that they engage in both formal and informal professional learning opportunities related to PBL facilitation and learning. Teachers at all three schools expressed that they approach other teachers to gain knowledge and support in PBL. While teachers referred to scheduled, formal professional learning opportunities as professional development, the term “professional learning” was preferred by the researcher for this study. This reconceptualization of professional development as professional learning is based on the work of Webster-Wright (2009), who highlighted the importance of the teacher as a “knowledge-possessing” provider rather than a “knowledge-deficient” professional (p. 713).

Across all three schools, teacher participants reported that they had attended either formal professional learning opportunities related to PBL, or had sought informal professional learning opportunities regularly in collaboration with other teachers. Teachers who had not engaged in formal professional learning opportunities expressed an interest in doing so and reported that they were supported by their administrators in their professional learning goals. While some teachers reported that they had not yet engaged in formal professional learning specifically for PBL, each of these teachers reported being actively engaged in and passionate about ongoing professional learning with other teachers and their students. Teachers described seeking advice from other teachers, observing other teachers’ classes and using social media, as well as attending workshops and courses focused on PBL. According to Opfer et al. (2011), teachers’ professional learning occurs individually as well as with others. In their view, teacher learning is
influenced by teachers’ “individual beliefs, practices, and experiential context” (p. 451). Each teacher participant in this study expressed a dedication to ongoing learning to improve their facilitation of PBL and to also help students reach their potential in each PBL project. Teachers also reported sharing new learning with others regularly. It was clear across participants that, regardless of the format, teachers sought new learning and also learned to lead new learning in their schools through facilitating PBL. Bruner (1996) describes teachers who demonstrate agency for learning as constructing new knowledge and understanding through social experiences. All participants in this study expressed a desire to continue to learn both from and with other teachers and their students, which further emphasizes that the teachers’ professional learning is both related and interrelated (Huberman, 1995).

**Challenges of PBL for Teachers**

Although PBL as a method of collaborative learning has both social and academic benefits, it also does not come without challenges for teachers. As described by participants, some challenges involved time constraints, student engagement, assessment, and group work. Typical challenges with group work include conflict among group members, unequal distribution of workload, and assessment of individual members. Cain (2012) describes three potentials for group work failure: not doing any work, preventing others from sharing ideas, and fear of judgement. The teachers expressed that creating a contract of work responsibilities helped to alleviate some of the potential effects of possible group work breakdowns. Teachers described keeping track of benchmarks and progress through ongoing observations and communication with the group members as a way of monitoring progress. Regular group discussion and individual conferencing is important to ensure flow or work within the groups and to address any other group challenges within each group (Johnson & Johnson, 2009). The teachers also described a dedication to group monitoring and acknowledgement of their contract
responsibilities. Ideally in PBL, every effort will be made to meet each student’s individual needs and to ensure optimal learning experiences within their respective groups.

Teachers also expressed difficulty with “letting go” and “stepping aside” during PBL. Learning to let students lead, according to the teachers, required experience and also the belief that important learning occurs when students are provided the opportunity to self-direct.

**Assessment**

Some teachers in this study reported that they find student learning can be difficult to assess throughout the PBL process. Portfolios have been found to serve not only as documentation of the learning process, but also as a tool that focuses on learning success rather than failure (Lavy & Shriki, 2008). At School B, Brooke shared her documentation process that incorporated pictures, captions, and words to capture her students’ work throughout the PBL process. She asserted that portfolios have the potential to motivate students, assist in their progress, and help develop their self-reflective skills, which are important twenty-first century skills (Trilling & Fadel, 2009).

**Time constraints**

At least one teacher at each school mentioned that time constraints are a challenge in PBL for teachers and for students. One of the teachers emphasized the importance of supporting the project process and expressed her belief that, if needed, more time may be important for student development as it may assist students in achieving a better-quality project. Another teacher expressed concern over coordinating cross-curricular experience for students. She suggested that a scheduled time for cross-curricular planning be established in the timetable in order to plan cross-curricular PBL effectively. An adjustment to the school schedule at School B was being made in response to teachers’ requests for PBL planning time with other teachers. As
this school had just made PBL a part of their strategic plan, it was clear that administration was dedicated to the implementation, development, and support for PBL.

**Teacher Leadership**

Through collaboration, teachers learn leadership skills that play a role in their practice, which affects students both directly and indirectly (Leithwood et al., 2004). Due to the collaborative nature of PBL, teachers who engage in PBL have the opportunity to demonstrate leadership. At each of the three schools, teachers reported that they were supported in their efforts in facilitating PBL. The teachers who participated in this study reported that their efforts in implementing PBL and continued efforts to learn to facilitate PBL better were supported by the administrators at each of their schools. According to Hattie (2012), a large part of the motivation behind teacher leadership and lifelong learning in schools is fueled by feedback about the impact of their work. Across the three schools, teachers expressed motivation to improve their facilitation of PBL and lead not just their students, but also other teachers through the process.

**Paradox in leadership**

It has already been discussed that teacher interviews across all ten schools revealed that teachers struggle with shifting control to the students. Teachers who work collaboratively also regularly face the challenge of balancing paradox, such as whether to promote fairness or rigidity (Stone, 2002). Teachers reported that, through encountering this challenge, they learned new teaching strategies to help scaffold student learning. Teachers also explained that they developed a sense of trust with their students and that through “letting go” they felt that they improved learning experiences for their students. Teachers who interact with paradox build upon
opportunities that result from diverse experiences (Cronin & Genovese, 2012), which may suggest why teachers reported learning through the challenges of balancing control in PBL.

**Limitations**

This study involved a small number of participants at three not-for-profit independent schools. It would be interesting to replicate this project in a variety of schools, with many more participants involved in PBL. Given that the schools in this study were independent schools that are funded directly by parents in the form of tuition, the findings may not be applicable to other school settings. Certain programs in independent schools may receive additional funds to support school projects like those described in this study. Families who contribute to independent schools through tuition, volunteering, and donations tend to have higher incomes which may also be linked to higher levels of education. In addition, although not-for-profit, independent schools generally have more discretionary funds and may have a higher level of parent support. It is also possible that some of the participants, knowing that the researcher has an interest in PBL, avoided voicing criticisms of PBL. The possibility of socially desirable responses is a limitation of interviews (Matthews, Baker, & Spillers, 2003).

**Implications for Research and Practice**

This study sought to gain an understanding of teachers’ perspectives about learning through collaborative experiences in PBL and to better understand what and how they learn in PBL both from and with other teachers and from and with their students. Teachers can build upon the unique strengths of their students and encourage social collaboration by incorporating a variety of teaching activities, such as PBL, into their practice (Katz, 1994). While PBL represents one method of collaborative learning, findings in this project suggest that teacher beliefs about facilitating learning are important for implementing PBL.
Research suggests that children learn best through social experiences facilitated by skilled teaching (Vygotsky, 1978). Ongoing professional learning and a commitment to supporting teachers engaging their students in PBL is necessary for effective facilitation of PBL.

Not exclusive to student learning, an innovative teaching and learning environment is important for teacher development as it provides teachers with a sense of personal contribution to the process of learning, increases motivation, and helps develop their ability to collect and share data (Lavy & Shriki, 2008, p. 281). Such an environment also enables teachers to further engage in PBL processes linked to investigation and collaboration (Krajcik et al, 1999). Sharing within schools, as well as beyond, has the potential to assist teachers in implementing new teaching methods which has the potential to engage more students and ultimately help more students learn how to learn.

Continued research around PBL will help teachers recognize their impact on both their students’ learning and on the learning of other teachers. Moving from the role of an instructional leader to a learning leader has been explained by Hattie (2011) as rooted in leaders’ beliefs and influenced by how their role is constructed. Learning how teachers view their role in PBL and how they learn to navigate throughout the collaborative process integral to PBL will add to this growing research around how teachers learn within the context of PBL.

**Educational Importance of the Study**

This unique study adds to the growing body of research surrounding teacher practice and teacher learning within the context of PBL. This study suggests that teachers who facilitate PBL engage in learning that takes place collaboratively and that skilled teachers who engage in PBL learn to lead their own learning. Knowing that PBL can be difficult to facilitate (Darling-Hammond, 2008) and that teachers often face a steep learning curve (Thomas, 2000), this study
sheds light on the beliefs these teachers hold in terms of teaching and learning collaboratively with their colleagues and their students. In addition, a greater understanding of what and how teachers learn through their practice is gained which contributes to research surrounding best practices in schools where teachers are engaging in collaborative opportunities with their colleagues and students.

Teachers who engage in collaborative work learn to lead their own professional learning. In providing the necessary supports for teachers in this area, schools can continue to provide learning opportunities that place equal emphasis on the development of their students and their teachers.

**Conclusion**

As part of a response to the diversity of today’s classrooms and the need to adapt to new teaching methods, teachers are required to familiarize themselves with various strategies that engage, assist, and support all students, with PBL being one example. Because collaboration within schools has the potential to assist teachers in implementing new teaching methods, in sharing teacher beliefs and collaborative experiences regarding PBL facilitation, educators may learn to apply collaborative practices to their own teaching and learning. Through their collaborative efforts and their willingness to adapt to new teaching practices, many teachers are working to respond to the urgency of developing skills for the future by providing collaborative programing for their students. However, progress toward such a vision relies on the commitment of all involved to work together to develop the necessary support to continue with its development and succession (Kotter, 1995). Ongoing professional development with a focus on professional learning (Webster-Wright, 2009) and a commitment to supporting teachers who facilitate PBL is necessary for effective implementation of PBL (Marx et al., 1997). However, it
is necessary to understand teachers’ perspectives about their learning in order to provide relevant quality professional development (Timperley, 2007; Webster-Wright, 2009).

Collaboration in schools that includes both student and teacher interaction is important for both student and teacher development. PBL provides a particular instance in which a greater understanding of the process of learning that takes place while working collaboratively can be gained. A further investigation into PBL facilitation and the teachers’ role in PBL will assist educators in continuing to provide quality learning experiences for students. With greater familiarity with the theoretical underpinnings that explain the process of learning through PBL, educators will better understand how to provide and support quality PBL experiences in their schools.
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Appendices

Appendix A. Informational/Consent Letter to the Principal

Dear Principal:

Thank you for considering participating in, or contributing to, my research project. As I noted in our first contact, I am a doctoral student in the Educational Leadership and Policy Program in the Department of Leadership, Higher, and Adult Education at the Ontario Institute of Education, University of Toronto. I am also a CAIS teacher and parent. I am interested in interviewing teachers involved in project based learning (PBL).

My research project is titled: Learning Collaboratively: An Examination of Teachers Facilitating Project Based Learning in Three Elementary Schools. The nature and purpose of the research is to learn about the perspectives of teachers engaged in PBL in the classroom and gain a better understanding of how teachers learn while collaborating throughout PBL. I plan to ask teachers questions about teaching strategies and beliefs as they relate to PBL. My research question is: What and how are teachers learning in the context of PBL, both from and with other teachers and from and with their students?

I plan to interview teachers about ways they teach students engaged in PBL and to observe a portion of a class in which the teacher is involved in PBL. I plan to take notes of my observations and an audio recording of the interview. I hope to learn more about facilitating PBL through speaking with each teacher.

The identity of the teachers will be kept confidential. No names, including the school name, will be used in any reports of publications. Teachers’ privacy will be protected to the fullest extent allowable by law. Only I will have access to the data. Your teachers’ names, your name, your students’ names, and the name of your school will always be kept confidential when oral or written presentation of the results of the study occur. This research has been reviewed and approved by the Human Participants Review Committee, the University of Toronto’s Research Ethics Board and conforms to the standards of the Canadian Tri-Council Research Ethics Guidelines.

There are no risks involved whether you decide to give consent or not for your teachers and school to participate in this study. While there are no specific benefits from participating, potential benefits you might derive from participating are gaining clarity or validating the use of your beliefs essential to PBL facilitation in your school and adding to a developing body of research on this topic. Your teachers’ participation is completely voluntary and he/she may choose to stop participating at any time. The teacher also has the right not to answer questions. Your decision to not consent will not influence the nature of your relationship with the University of Toronto, the researcher, your school, your teachers, your students, or any other group associated with this project either now, or in the future. All data generated as a consequence of your teachers’ participation shall be destroyed if you decide to withdraw. You are under no obligation to have your teachers participate and you may terminate his or her participation at any time.
A rich descriptive analysis will be used to better understand teachers’ involvement in PBL in their classrooms. The results will be synthesized with the growing body of knowledge on PBL, collaborative learning, and best practices. I will keep a master list of correspondences in a locked file drawer. Confidentiality and anonymity will be provided and respected to the fullest extent possible with participants listed as numbers or pseudonyms. This list will only be available to me. After data is analyzed and prepared in final form as results (articles and/or conference presentations), this list will be destroyed by shredding. After 5 years, all data will be shredded and deleted from disk. Only in the event that the study is chosen for an audit within this time will the ethics office be able to view the data. Only in the event that the study is chosen for an audit within this time will the ethics office be able to view the data. I can send you a copy of the final report if you would like to have a copy.

I really appreciate your help and if you have any questions about this study, I can be reached at [redacted] or matina.mosun@mail.utoronto.ca. Also, please feel free to contact the Research Oversight and Compliance Office - Human Research Ethics Program at ethics.review@utoronto.ca or 416-946-3273.

Thank you,

Sincerely,

Matina Mosun
Ed.D. Candidate

[redacted]
Appendix B. Informational/Consent Letter to Teacher Participants

Dear Teacher:

Thank you for considering participating in, or contributing to, my research project. As I noted in our first contact, I am a doctoral student in the Educational Leadership and Policy Program in the Department of Leadership, Higher, and Adult Education at the Ontario Institute of Education, University of Toronto. I am also a CAIS teacher and parent. I am interested in interviewing teachers involved in project based learning (PBL).

My research project is titled: Learning Collaboratively: An Examination of Teachers Facilitating Project Based Learning in Three Elementary Schools. The nature and purpose of the research is to learn about the perspectives of teachers engaged in PBL in the classroom and gain a better understanding of how teachers learn while collaborating throughout PBL. I plan to ask teachers questions about teaching strategies and beliefs as they relate to PBL. My research question is: What and how are teachers learning in the context of PBL, both from and with other teachers and from and with their students?

I plan to interview teachers about ways they teach students engaged in PBL and to observe a portion of a class in which the teacher is involved in PBL. I plan to take notes of my observations and an audio recording of the interview. I hope to learn more about facilitating PBL through speaking with each teacher.

The identity of the teacher will be kept confidential. No names, including the school name, will be used in any reports of publications. Teachers’ privacy will be protected to the fullest extent allowable by law. Only I will have access to the data. Your teachers’ names, your name, your students’ names, and the name of your school will always be kept confidential when oral or written presentation of the results of the study occur. This research has been reviewed and approved by the Human Participants Review Committee, the University of Toronto’s Research Ethics Board and conforms to the standards of the Canadian Tri-Council Research Ethics Guidelines.

There are no risks involved whether you decide to give consent or not for your teachers and school to participate in this study. While there are no specific benefits from participating, potential benefits you might derive from participating are gaining clarity or validating the use of your beliefs essential to PBL facilitation in your school and adding to a developing body of research on this topic. Your teachers’ participation is completely voluntary and he/she may choose to stop participating at any time. The teacher also has the right not to answer questions. Your decision to not consent will not influence the nature of your relationship with the University of Toronto, the researcher, your school, your teachers, your students, or any other group associated with this project either now, or in the future. All data generated as a consequence of your teachers’ participation shall be destroyed if you decide to withdraw. You are under no obligation to have your teachers participate and you may terminate his or her participation at any time.

A rich descriptive analysis will be used to better understand teachers’ involvement in PBL in their classrooms. The results will be synthesized with the growing body of knowledge on PBL, collaborative learning, and best practices. I will keep a master list of correspondences in a locked file drawer. Confidentiality and anonymity will be provided and respected to the fullest extent possible with
participants listed as numbers or pseudonyms. This list will only be available to me. After data is
analyzed and prepared in final form as results (articles and/or conference presentations), this list will be
destroyed by shredding. After 5 years, all data will be shredded and deleted from disk. Only in the event
that the study is chosen for an audit within this time will the ethics office be able to view the data. I can
send you a copy of the final report if you would like to have a copy.

I really appreciate your help and if you have any questions about this study, I can be reached at [blank] or [blank]. Also, please feel free to contact the Research Oversight and Compliance Office - Human Research Ethics Program at ethics.review@utoronto.ca or 416-946-3273.

Attached to this letter you will find the following section, which will give you more information. Please make a point of reading the section carefully before signing:

Section A

Thank you,

Sincerely,

Matina Mosun
Ed.D. Candidate

Section A

(Where participants are individually interviewed and audio taped interviews constitute the raw data)

This study involves you participating in one interview with me. The interview will be informal and will last approximately one hour.

Areas I hope to touch on are:

How do intermediate teachers learn to facilitate collaborative experiences in PBL?

Examples of questions that I have in mind but may or may not ask depending on priorities that emerge and how dialogue evolves are:

Describe how you facilitate project based learning in your subject area.
How would you describe your role in facilitating this type of learning?
How would you explain your perspective of collaboration in project based learning?

Once the audiotapes of the interview(s) have been transcribed, the original or raw data will be stored under lock and key. Only I will ever have access to this raw data. In the transcripts, names and other identifying information about you or your organization will be systematically changed. Identifying codes that could connect you or your organization with the changed names will also be kept under lock and key in the place designated above. The timing for the destruction of the tapes and/or the raw data is five years after the completion of the study.

As interviewee, you may request to receive a copy of the transcript of your interview. Any section which you request to have deleted from the transcript of your interview will be deleted. You are free to withdraw from the study at any time, and you may request that the entire transcript of your interview be destroyed. I will be sharing major aspects of my preliminary analysis with you and you have the opportunity to provide feedback. I may email you with key ideas, and offer my availability to meet with you at your convenience if you wish to discuss the findings.
To Be Completed by the Participants

I have read this document and any enclosed documents. I understand what is being asked and the accompanying conditions and promises. I understand the nature and limitations of the research.

I understand that I am free to withdraw my participation at any time.

I agree to participate in the ways described. □

If I am making any exceptions or stipulations, these are:

I do not wish to participate in the research. □

__________________________________________ (Signature)
__________________________________________ (Printed Name)
__________________________________________ (Date)
Appendix C. Classroom Observation Protocol

Physical Environment

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Describe the learning area (i.e., desks, seating, tables, standing/sitting); note anything that seems to enhance or distract from learning</td>
<td></td>
</tr>
<tr>
<td>Describe the number of students, boys/girls, languages, ethnicity</td>
<td></td>
</tr>
<tr>
<td>Describe the location of the teacher and the teacher’s movement in the learning space; note when movement occurs in the classroom</td>
<td></td>
</tr>
<tr>
<td>Describe materials and resources used by the teacher and students (i.e., posters, technology, charts)</td>
<td></td>
</tr>
</tbody>
</table>
### Teaching and Learning Climate

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Describe the learning goals of the class</td>
</tr>
<tr>
<td>Describe the teaching and learning strategies the teacher utilizes/employs; Does the classroom features a mixture of individual and team work time, whole group and small group instruction?</td>
</tr>
<tr>
<td>Describe classroom interactions (teacher/student; student/student; and teacher/teacher); note when interactions occur throughout the period</td>
</tr>
<tr>
<td>Describe any group work, collaboration, team work in the class and record dialogue; Is the teacher involved in the group work? Describe any differentiation.</td>
</tr>
<tr>
<td>Note how often the teacher redirects a group and how the teacher scaffolds learning and note when it occurs throughout the period and record dialogue; Does the teacher emphasize that it is OK to take risks, make mistakes, and learn from them?</td>
</tr>
</tbody>
</table>
Appendix D. Interview Questions

Although the interviews will be semi-structured, there will be some questions asked in the interviews that will be consistent among the participants.

These are:
1) How do you describe project based learning?
2) How did you learn about project based learning?
3) Describe some examples of project based learning you’ve been involved with.
4) How would you describe your role in facilitating this type of learning?
5) What changes have you made to your facilitation of project based learning since you first began facilitating project based learning?
6) Describe what activities your students engage in through project based learning
7) What do you expect students to learn throughout the experience?
8) What do you expect yourself or other teachers to learn throughout the experience?
9) How would you explain your perspective on collaboration in project based learning?
10) What challenges do you experience during project based learning in your subject area?
11) What types of support are in place to assist you with facilitating project based learning?