A Statewide Community of Practice: Professional Development for Science Teachers

By

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ABSTRACT

The introduction of new curriculum poses a range of challenges for both new and experienced teachers. To overcome these challenges teachers need appropriate trainings and support. Research shows that communities of practice (COP) are valuable for teacher development and correlated to good teaching. COPs can be difficult to create because teachers are pre-conditioned to work in isolation. The purpose of this qualitative study was to consider how the COP model, at the state level, used the expertise of both new and experienced teachers. In addition to supporting experienced teachers in transitioning to problem-based learning (PBL), this could be an effective method of bringing new teachers into the profession. The study was conducted with high school and middle school science teachers from across New Jersey. The following research questions guided the research study: (1) What takes place in a community of practice focused on developing problem-based learning? (2) What are participants' perceptions of the value of the statewide community of practice? These research questions were addressed by using feedback forms, informal conversations, a focus group, observations and collecting documents, from twelve participants (myself included) over four months. After reading the data multiple times, coding, and identifying patterns and themes, interpretations were made. Findings showed the importance and particularities of my leadership in structuring and facilitating the meetings to meet the teachers' needs and that novice teachers worked alongside of experienced teachers to contribute to the collective knowledge of the group. The teachers reported positive experiences during the COP and they appreciated the support provided by like-minded peers. The overall findings of this study also support that from the teachers' perspectives, a statewide community of practice promotes and sustains ongoing professional growth. Three claims were made when discussing findings: 1) this is a new type of community of practice with unique teacher leadership and willing participants; 2) teachers should have a voice and choice in selecting their own learning communities, and 3) it is possible to create conditions in which novice teachers are full and active participants from the beginning. Practical recommendations and suggestions for future research are presented.

Keywords: communities of practice, professional development, science education, problem-based learning, next generation science standards

Dedication

I would like to dedicate this work to my parents, Pete and Linda, as well as the rest of my family who have supported me throughout my life. Thank you for always believing in me. You have taught me to work hard for the things I aspire to achieve. No one is luckier than I am to have such a wonderful and loving family.

I would also like to dedicate this work to my husband Michael who is also a constant source of support and encouragement during the challenges of graduate school and life. I give you my deepest expression of love and appreciation for the sacrifices you made so that I can achieve my goals. I am truly thankful for having you in my life.

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Chinese philosopher Lao-tzu said, “A journey of a thousand miles begins with a single step.” For me the first step began when I showed up to the first class in this doctoral program feeling overwhelmed and out of place. Having very little experience scholarly writing, I knew it was going to be an uphill battle: a battle that could not have been fought without the support of my friends and colleagues. First and foremost, I would like to acknowledge and thank the 2012 cohort, especially the Teacher Leadership concentration. Etienne Wenger said, “Communities of practice are groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly.” Specifically, Linda Edwards, Jennifer Kamm-Greco, Sandra Lynch, Matthew Mingle, and Susan Watkins who connect, inspire, collaborate, challenge, and share with me personally and professionally. I am thankful for your passion. I had no idea I would leave this program with such amazing friendships.

I chose to conduct my research with science teachers from different school districts because of my passion for both science education and professional development. This passion has grown as I have had the privilege of working with the dedicated and hardworking science teachers in my study. I would like to thank these teachers for allowing my to lead them, for participating in my research study and for helping me to learn more about communities of practice through your words and actions. It is truly a pleasure to work with all of you and to see you grow.

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CHAPTER ONE: INTRODUCTION

The introduction of new curriculum poses a range of challenges for both new and experienced teachers. In order to implement new curriculum teachers need professional development, strong leadership, and shared vision (Fullan, 2007; Hall & Hord, 2006). In addition, teachers need to feel as though they have ownership over the new curriculum, as this could affect their attitude and acceptance during the implementation process (Reeves, 2009). Change can seem intimidating and often, can be met with opposition. Teachers may have to do more work, under the same conditions while others believe that they lack the capacity to teach new curriculum (Fullan, 2007; Hall & Hord, 2006; Pecore, 2013). Unfortunately, based on the daily rigors of the job and countless additional obstacles, teachers may not have enough time to learn new curriculum, have access to adequate resources, and time to develop new instructional practices in order to be successful at implementation (Obara & Sloan, 2009; Ertmer, 2014; Pecore, 2013). To overcome these challenges teachers need appropriate training and support.

Traditionally teachers are expected to acquire the skills, knowledge, and tools to implement a new curriculum through professional development (PD) provided within their schools. However, this PD is often provided in one-shot workshops that lack follow-through and that fail to create a community of learners among the staff of a school (Putnam & Borko, 2000; Shulman & Shulman, 2008; Wilson & Berne, 1999; Wood, 2007; Zwart et al, 2007). "School learning environments [for teachers] typically do not emphasize sharing a learning and cognitive performance, focusing instead on the importance of individual competencies" (Putnam & Borko, 2000, p.5). Wilson and Berne (1999) conclude we live in a culture that does not necessarily reward or value knowledge. It is no surprise teachers in many schools have come to accept a certain level of professional isolation, where they seek ideas from books, the Internet, a few

workshops or conferences and from one or two teachers with whom they share a close relationship. This constitutes the model of professional learning to which most educators are accustomed.

Research shows that communities of practice (COP) are valuable for teacher development and are correlated to good teaching (Cochran-Smith & Lytle, 1999; Lave & Wenger, 1998; Morrell, 2003; Woodgate-Jones, 2012). A community of practice as Lave and Wenger (1998) state "are groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis." Developing a community of practice is more than just teachers coming together to complain about a situation. It is about creating a sense of culture with distributed leadership where members can lean on one another to solve problems (Dana & Yendol-Hoppey, 2008). Members of this type of learning community ideally understand and embrace collaboration.

Communities of practice align with best practices in professional development because COPs include (1) a culture of collaboration, (2) sharing best practices, and (3) creation of new knowledge (Cochrane-Smith & Lytle, 1999; Lave & Wenger, 1998). COPs go a step beyond professional development by providing teachers with not just skills and knowledge to improve their teaching practices, but also an ongoing community that values teachers' experiences and uses those experiences to guiding teaching practices. By working collaboratively, teachers are able to create, foster, and sustain working COPs over long periods of time making this type of professional development more effective (Cochrane-Smith & Lytle, 1999; Putnam & Borko, 2000; Wilson & Berne, 1999). Members of a COP have an opportunity to develop individually and work together to advance their field of practice.

Even though research indicates that communities of practice work to engage teachers in collective learning, they can be difficult to create because teachers are pre-conditioned to work in isolation of each other (Putnam & Borko, 2000; Shulman & Shulman, 2008; Wilson & Berne, 1999; Wood, 2007; Zwart et al, 2007). This is particularly true in secondary schools because teaching is content specific and teachers therefore have limited numbers of colleagues available to collaborate. In addition, the pool of willing teachers is further narrowed within a school or even a district due to the fact that not all teachers are interested in collaborating (Shulman & Shulman, 2008).

Problem of Practice

New Jersey recently adopted the Next Generation Science Standards (NGSS), which were created with the goal of helping students become more scientifically literate. In order to do this, the standards had to shift the instructional emphasis from breadth to depth, with a focus on science skills, critical thinking, and scientific practices (NCR, 2012). One example of an inquiry-based pedagogical practice in science education that aligns with the NGSS and that is currently being implemented in some schools is problem-based learning (PBL). Problem-based learning, as defined by Hmelo-Silver (2004), is a type of learning in which students grapple with real world problems that are designed to have no one correct answer. With the guidance of a teacher, students work collaboratively to construct their own knowledge by using driving questions and scientific inquiry (Hmelo-Silver, 2004). Problem-based learning emphasizes content, 21st century skills and is designed to prepare students for deeper thinking.

Instituting these changes in science education requires teachers who are knowledgeable about science content, processes, and inquiry-based pedagogy. While many teachers are already teaching for application of concepts and core ideas, the use of the NGSS will cause a shift in

instruction from a teacher-centered approach, where the teacher is the "sage on the stage", to a more student-centered approach, in which the teacher acts as a "guide on the side". Ultimately, changes in science education will require a particular teaching skill set that is new for most educators.

As an early adopter of NGSS and PBL I have been asked to give presentations to teachers about the topics (Hall & Hord, 2006). During these presentations I discovered that teachers were struggling with implementation. Some of these teachers reported that they could not try it out because it was "not how they taught in their schools"; while other teachers reported they did not have colleagues who could offer support because of their own lack of knowledge. During the 2013-2014 school year, I worked with new and experienced teachers from different schools to help develop lessons and share ideas with regard to implementing problem-based learning. These teachers and I have come together because of the limited availability of willing teachers to collaborate within our own schools. In fact, in most cases there were no COPs for these teachers to join within their own schools; that is why I decided to create a COP that could include high school and middle school life science teachers across the state of New Jersey.

As such, the purpose of this qualitative study is to consider how the COP model, at the state level, uses the expertise of both new and experienced teachers. It is my hope that in addition to supporting experienced teachers in transitioning to PBL, this could also be an effective method of bringing new teachers into the profession. This study will examine the perceptions, experiences, and opinions of the participants within the COP. The study's research focus is designed to explore the following questions:

1. What takes place in the community of practice focused on developing problem-based l earning?

a. How is the COP structured?

b. What activities are teachers engaging in?

c. How does the COP work when there are varying levels of experience among the participants?

2. What are participants' perceptions of the value of the statewide community of practice?

a. How do the participants describe the experience of participating in the community of practice?

b. What do participants say about the quality of the learning that occurs in the COP?

c. Do the participants believe that the COP impacted their teaching practices? If so, how?

d. How do perceptions of participants differ depending on their level of experience?

CHAPTER TWO: REVIEW OF THE LITERATURE

To set the stage for this proposed study with what we know about implementing new curriculum and professional development, this review begins with an overview of research on addressing the Next Generation Science Standards through problem-based learning. This general review is followed up by a review of research on best practices in professional development for implementing PBL. Finally, a review of the literature on communities of practice is presented with a focus on the importance of COPs and how they contribute to teacher learning.

Addressing Standards through Problem-Based Learning

With the recent adoption of the Next Generation Science Standards, teachers are rethinking how they teach science. Created by the science education community and the National Science Teachers Association and released to the public in the spring of 2013, the NGSS were created with the goal of helping students become more scientifically literate. In order to do this, the standards had to shift the instructional emphasis from breadth to depth, with the focus on science skills, critical thinking, and scientific processes (NCR, 2012). The new science standards are not a revision of content, but fundamentally shift science education toward inquiry-based approaches (Duncan & Rivet, 2013). Students are being asked to develop and use models, plan and carry out investigations, analyze and interpret data, construct explanations, engage in arguments from evidence, and communicate information (NCR, 2012). Instituting this change is going to require teachers who are knowledgeable about science content, processes, and inquiry-based pedagogy. While there are teachers already teaching for application of concepts and core ideas, the use of the NGSS will cause a shift in instruction from a teacher-centered approach, where the teacher is the "sage on the stage" to a more student-centered approach, in which the teacher acts as a facilitator. Due to the fact that the NGSS are based on assumptions of a student-

centered classroom of inquiry, ways of teaching and models of professional development must reflect the change.

Problem-based learning (PBL) is one pedagogical approach that can be used to help teachers implement a student-centered classroom. In PBL, students work in collaborative groups to investigate, explain, and potentially solve authentic problems (Hmelo-Silver, 2004). An important aspect of PBL is the self-directedness of the students as they investigate and identify their own "knowledge deficiencies" (Hmelo-Silver, 2004, p.236). The NGSS focuses not only on content, but 21st century skills as well, and as the state moves toward implementing these new standards, PBL provides strategy for deeper thinking. Changes in science education require a particular teaching skill set that is new for most, however teachers are usually not effectively trained in PBL (Asghar et al, 2012; Pecore, 2013).

One struggle echoed by the teachers I have met revolved around their insecurities of leading a PBL classroom. None of the teachers mentioned having ever been taught through a PBL approach, nor have they received professional development on how to implement the strategies. For many teachers, the greatest challenge of PBL is adapting themselves to the role of facilitator (Gordon et al, 2001; Kanter & Schreck, 2006; Schneider, 2002). According to English and Kitsantas (2013), the switch from passive learners to active, collaborative, self-regulating learners is an essential component in a PBL classroom and professional development is required to build the capacity for the teachers to lead this change effectively. The Next Generation Science Standards will require teachers to consider ways to not only deepen science learning, but also plan lessons that will scaffold student engagement with the practices (NCR, 2012). The implication of this shift in teaching practices requires support for teachers to share practices and pedagogical skills to implement PBL in their classrooms. This research study aimed to address

the need for professional development in the form of a community of practice to help train teachers in PBL.

Professional Development for PBL

Teachers face many challenges when implementing problem-based learning such as adopting new methods of teaching, addressing student learning in new ways, and learning how to use new materials (Obara & Sloan, 2009). Thus, professional development is needed to help teachers integrate PBL. Professional development influences teacher outcomes in terms of adoption and sustained use of innovative practices (Thomas et al, 2012). Garet, Porter, Desimone, Burman, and Yoon (2001) determined effective structural features (type of activity, duration, collective participation) and core features (content focus, active learning, fostering coherence) in professional development, which lead to enhancing knowledge and skills, and changes in teaching practice. These kinds of structural and core features reflect the importance of creating opportunities for teacher discourse- teachers collaborating and talking about their learning and their practice. Wilson and Berne (1999) argue that effective professional development provides teachers with opportunities to talk about (and "do") subject matter, talk about students and learning, and talk about teaching. Furthermore, Shulman and Shulman developed a model to reflect this new movement of professional development called Fostering a Community of Learners. They argue that teacher learning occurs with a combination of vision, motivation, understanding, practice, reflection, and community (Shulman & Shulman, 2008). While models of professional development are evolving, research should connect professional development with problem-based learning.

A small group of studies has begun to look specifically at how professional development is implemented in efforts to enhance teachers' use of problem-based learning. The studies

reviewed contained mostly small sample sizes of teachers who participated in workshops that addressed questions about teachers' perceptions of using problem-based learning in their own classrooms. Each study is unique in setting and type of professional development.

Two of the four studies reviewed were small case studies that focused on having teachers create their own PBL lessons (Asghar et al, 2012; Pecore, 2013). In one study, researchers looked at preparing teachers to facilitate STEM (science, technology, education, and math)-PBL in their Maryland schools (Asghar et al, 2012). A five-day workshop spanning over five months was conducted for forty-one teachers. The professional development included learning PBL through activities, discussions, and lectures. Teachers were given homework in between each session and posted their own PBL lessons through an electronic forum. The teachers were interviewed and surveyed throughout the PD experience. At the end of the study, the researchers found that teachers' perceptions of PBL had changed and that they had a greater understanding of how PBL aligns with STEM education (Asghar et al, 2012). Even though the professional development shifted teacher beliefs about PBL, the study found that teachers did not implement PBL in their own classrooms.

In a similar qualitative cases study, Pecore (2013) studied four teachers' classroom practices during PBL instruction after participating in a one-week summer workshop. During the workshop teachers observed, experienced, and worked collaboratively to design PBL lessons. Using a constant comparative method between interviews and observations, the researcher found that all four teachers believed they were doing PBL in their classrooms. Teachers experienced surface changes in their understanding of PBL, but the lessons did not align with best practices in PBL. Similar to Asghar et al. (2012), there was resistance by the teachers towards the PBL approach. These models reflect the importance of sharing learning between experts and peers in

a collaborative setting. These studies are significant to the current study because the state level COP worked to shift the teacher's pedagogy through sustained, job-embedded professional development teaching each other about PBL. Participation in a collaborative, peer-led environment provided the support teachers needed to move forward with implementation.

Ertmer, Schlosser, Clase, and Andedokun (2014) and Haney, Wang, Keil, and Zoffel (2007) conducted quantitative studies on teachers' abilities to implement PBL after receiving professional development. Ertmer et al. (2014) analyzed teacher knowledge and confidence of 21 teachers before and after a nine-day summer workshop for STEM teachers focused on global issues of climate change. While Ertmer et al. (2014) did not explain the kinds of professional development the participants' experienced, they used pre and post surveys to collect data on teacher knowledge and confidence. They triangulated their data with teachers' daily reflections and focus group interviews. A two-tailed paired t-test revealed that teachers had an increase in knowledge and confidence for using PBL. Results specifically showed significance with teachers feeling as though they had gained new strategies for teaching and learned all the components of PBL from start to finish. Although the results are positive, none of the teachers were able to implement PBL and reported that they were not as confident with planning PBL lessons by themselves.

Haney et al. (2007) conducted a study of 18 middle school science and non–science teachers to understand changes in teacher beliefs and, unlike the previous studies, reported an increase in the frequency of use of PBL practices in their classrooms after participation in a two-year professional development course. Haney et al. (2007) explained that after two years of professional development on PBL that included summer workshops and monthly meetings

during the academic year, teachers' beliefs of PBL were enhanced and have reported more frequency of use of PBL lessons in their classrooms.

Overall, the researchers found that teachers learned more about how to implement problem-based learning through various professional development experiences, but with the exception of Haney et al. (2007), teachers did not report making the changes in their own classrooms. Even though teachers reported positive experiences with PBL, the professional development did not seem to help teachers transfer knowledge into practice. This poses a problem for creating professional development for teachers on PBL because there does not seem to be a form of PD that researchers believe is helpful. There seems to be room for improvement in the area of professional development for PBL.

Communities of Practice

Teachers are often isolated in their classrooms and a collaborative culture does not exist. This isolation leads to "continued ineffective practices" because teachers lack a frame of reference for comparison (Schmoker, 2006, p.24). In contrast to the rest of the professional world, teachers do not typically work in teams, which is why in recent years the role of communities in the process of learning has gained much attention (Mittendorff et al, 2006). Communities of practice provide teachers with a context for doing so as a way to improve their craft and knowledge. According to researchers, an effective COP includes (1) a culture of collaboration, (2) sharing best practices, and (3) creation of new knowledge (Cochran-Smith & Lytle, 1999; Lave & Wenger, 1998; Wenger et al, 2002). Communities of practice are unique in that they may not include people who work together every day, but meet because they find meaning in the collaboration (Mittendorff et al, 2006; Wenger et al, 2002). The studies that will

be reviewed in this section will focus on research regarding communities of practice and will illustrate evidence-based principles of using communities of practice.

The six research studies reviewed are all small qualitative studies that addressed questions about the strengths of communities of practice on teacher development (Fazio, 2009; Jimenez-Silva & Olson, 2012; Klein, 2008; Morrell, 2003; Nishino, 2012; Woodgate-Jones, 2012). These studies focused on identifying key components necessary for maintaining successful communities of practice. Each study is unique in setting and sample. Overall, the studies found that teachers working in COPs developed a sense of community, improved their teaching practices, and generated new ideas.

Developing a community of practice is about creating a sense of community with distributed leadership. For example, Klein (2008) and Morrell (2003) completed small case studies of pre-existing communities of practice to determine teachers' experiences within the COPs. Klein studied three teachers as they built new content and pedagogical content knowledge, learned how to let go of deeply held assumptions of teaching and learning, and created new understandings of teaching and learning. Morrell studied five teachers who participated in an action research seminar that focused on issues of equality in education. Both articles discuss similar methods of data collecting and analyzing data; interviews, surveys, document analysis, and coding for themes (Klein 2008; Morrell, 2003). Finally, both articles reported findings that teachers were able to engage in meaningful discourse and solve problems that were critical to their problems of practice, which they could not have done on their own. The ability to build such teacher capacity occurred in both cases because the teachers had a built in community with shared leadership and used authentic dialogue to connect the professional experience to their practice. This research supports the need to explore a statewide COP in which

teachers can share leadership and expertise to learn from one another to build their capacity to implement PBL.

Fazio (2009) and Nishino (2012) specifically studied teachers' beliefs about participating in communities of practice. Fazio (2009) analyzed interviews, meetings, and journal entries of four science teachers to document the change in their perceptions of participating in a community of practice. Nishino (2012) conducted a qualitative narrative analysis of one Japanese teacher struggling to integrate more progressive pedagogical strategies in an English classroom. While Fazio (2009) did not explain the extent to which the COP met to develop the teacher's' plans for their action research projects, the data was coded for themes surrounding teachers' views of the COP. All of the teachers reported that their collaboration contributed to their self-efficacy and changed their views on the nature of science. In addition, the teachers critically examined their current practices and generated shared curriculum. Nishino (2012) explained that after participating in two communities of practice the Japanese teacher reported that the COPs promoted teacher learning and was successful at implementing the new Japanese curriculum. In all, findings suggest that there was a shift from isolation to interdependence, which is an essential element for an effective COP. These studies were important in guiding my research study because they showed that teachers who engaged in collaborative practices such as a COP were more likely to implement changes in their classrooms.

Jimenez-Silva and Olson (2012) and Woodgate-Jones (2012) found that communities of practice were the key to bridging the gap between theory and practice for pre-service teachers. Both of the studies looked at pre-service teachers' involvement in COPs moving from peripheral participant to full participant during the meetings. In addition, pre-service teachers in both studies worked with master teachers during a semester of student teaching. Jimenez-Silva and

Olson (2012) collected data through written reflections, course evaluations and semi-structured interviews, while Woodgate-Jones (2012) collected data by using open-ended interviews and focus groups. Participants in both studies reported that the COPs provided a safe and trustworthy place to share stories and develop relationships. In addition, researchers found that the student teachers saw the COPs as a stress-free environment where they could bring in new ideas and develop lessons. The head teachers in the studies reported that the COPs provided a time for reflection, which helped them with their own practice. These findings suggest that pre-service teachers developed trusting relationships that grew out of the collaboration of the communities of practice.

The major limitation of the six studies examined in this section is that they are all small qualitative studies: the largest sample focused on 33 teachers across two schools (Jimenez-Silva & Olson, 2012) while the smallest focused on only one teacher (Nishino, 2012). In addition, the findings focused almost entirely on interview data from the teachers rather than observations. However, based on the limited findings of these studies, it appears that communities of practice provided opportunities for critical conversations amongst teachers and created a collaborative culture (Fazio, 2009; Jimenez-Silva & Olson, 2012; Klein, 2008; Morrell, 2003; Nishino, 2012; Woodgate-Jones, 2012). While these studies are not generalizable nor do they address implementing problem-based learning they did provide a beginning framework for a statewide community of practice for science teachers.

Communities of practice provide a collaborative group of like-minded teachers in which they can share best practices and create new knowledge over a long period of time. This collective learning can improve teacher practices and optimize the learning of the teacher (Mittendorff et al, 2006). With this type of support teachers may be more likely to implement

problem-based learning in their classrooms. More research is needed on how communities of practice can support teachers overcoming obstacles associated with implementing PBL. In addition, studies utilizing a community of practice as an intervention are needed to explore how participation is this form of professional development influences teachers' likelihood of implementing PBL.

Challenges of collaboration. Teachers are often isolated in their buildings and a collaborative culture does not exist. In fact, there are many barriers that exist in creating a collaborative culture, such as time, leadership, and shared vision. There are no empirical articles that surround the topic of challenges in creating communities of practice. However, articles spanning the topic of professional learning communities discuss the challenges of creating a collaborative culture within schools. The four research studies reviewed are once again all small case studies that addressed questions about strength of professional learning communities on teacher development (Graham, 2007; Hipp et al, 2008; Strahan, 2003; Wood, 2007). These studies do not measure outcomes of teacher learning; but rather focus on identifying the key components necessary for maintaining successful learning communities.

Wood (2007), using vignettes, looked at how two different learning communities operated within the same school district. The first vignette tells the story of a group of twenty-one middle school teachers who were placed with an internal coach based on teacher concerns with low student test scores. The focus of this community of teachers was on best practices to prevent teachers from doing the same old lessons that don't work well. The other vignette tells the story of four elementary school teachers brought together by their principal based on their existing grade-level teams. The goal of the community was to link professional development to on-going work and for teachers to share expertise. Although both vignettes brought teachers

together, the latter was more successful in building knowledge because teachers had shared leadership, used protocols and used authentic dialogue to connect professional experience to their practice. This study showed that while it is easy to bring teachers together, it is not always as easy to create a sense of ownership and build teacher capacity.

Graham (2007), Hipp, Huffman, Panake and Olivier (2008), and Strahan (2003) looked at professional learning communities that were embedded in teachers' daily work during common planning time. While the studies show that the teachers were collaborative, only Strahan (2003) reported that there was an increase in shared practices. The studies report that the participants in the learning communities did not have shared vision. Although teachers in all three studies were given common planning time during the school day, they did not use the time effectively. Allocating time for teachers to collaborate does not necessarily lead to improved teacher development. Common pitfalls of community of learners often relate back to a lack of a clear vision shared among all participants (Dana & Yendol-Hoppey, 2008; Putnam & Borko, 2000). Learning communities must establish goals that have meaning to the participants involved. These studies were important in guiding my research study because they showed that forcing collaboration does not always lead to professional growth and knowledge building. Teachers need to work with other teachers who have the same vision and goals.

Communities of practice can work to build teacher capacity but there are quite a few barriers that hinder successful collaboration of science teachers in New Jersey. The physical constraints of school schedules do not enable time for teachers to meet. In addition, only a handful of schools in New Jersey are using problem-based learning as a form of pedagogy. A state level community of practice assists in breaking down these barriers.

Leadership within a COP. Leaders play an important role in creating and sustaining communities of practice. Researchers have found that there are key tasks and behaviors performed by leaders that result in successful learning communities (Baker-Eveleth et al, 2011; Borg, 2012; Bourhis et al, 2005; Luebka, 2014; Printy, 2008; Thornton & Cherrington, 2014; Wenger et al, 2002). The studies have showed how leadership can support the development of learning communities and the importance of the leader in their ability to promote shared values, develop strong relationships, encourage risk taking behaviors, facilitate learning, and promote the self-efficacy of teachers. Leadership is clearly vital to the successful implementation of learning communities. For the purpose of this study, my focus is on the particular actions leaders took to support teachers during communities of practice and professional learning communities.

Mutual engagement. One important step COP leaders must take to foster a COP is to develop collegial relationships and group norms by working with the participants involved. The health of any COP depends on "the voluntary engagement of its members and on the emergence of internal leadership" (Borg, 2012, p. 313). Through her study of middle school teachers, Borg found that leadership was distributed amongst the participants depending on the needs of the members. Each member of the COP brought different expertise, which ended up being important in times of needs, such as curriculum development. The significant point in Borg's work was the importance of all members embracing leadership roles to sustain collaborative practices. In addition to the internal leadership within the group, external leadership from the building principal was also crucial for sustaining the COP. Printy (2008) also found leadership from high school principals and department chairpersons to be influential in determining the quality of teachers' participation in the COP. Specifically, the research showed that the leaders shaped the agenda for learning and facilitated the exchange of knowledge between and among the

participants. Printy also found that by combining all levels of expertise promoted teacher learning. Leaders play an important role in creating conditions for rich interactions that result in collaboration.

Joint enterprise. As leaders work towards developing collaborative practices, they must also work with participants to develop a clear vision and aligned goals. According to Lave and Wenger (1998), COPs can evolve organically because all of the members share common interests in a particular area and that the common interest binds the group together. This joint enterprise is negotiated by its members and helps to guide their learning. Bourhis, Dubé, and Jacob (2005) found that in two of the eight virtual communities of practice (VCOP) they studied, the leaders were more than just facilitators, they maintained the vision of the group and worked with members and coaches to carry out the goals. They found that the leaders did not work alone in constructing the vision; they worked with the core team members to develop the community's mission and purpose. These two VCOPs were identified as successful ones due to strong leadership. Similarly, Thornton and Cherrington (2014) argued that actions of leaders influence the leadership of others. After studying four PLCs over six months, they also identified leadership as the most important factor that contributed to the success of the PLCs. They also found that the members of the successful PLCs contributed to and agreed on the purpose and focus of their work together, but due to the support and commitment of the leaders to the vision, the participants experienced permanent shifts in their practices. Typically, communities of practice are informal, meaning the members organize themselves and set their own agenda. The research shows that participants are involved in creating their own vision, however, leadership is important in helping to maintain the vision and when leadership is shared and supportive, the result is a much more successful learning community.

Shared repertoire. The final aspect of a community of practice involves the continual development and maintenance of shared procedures, techniques, stories, and resources. In fact, meetings should be "intense, rich in content, and engaging members in good discussions (Wegner et al, 2002, p. 37). By doing so members of a COP reach new levels of understanding. In addition, by having participants explore and produce things together, it gives the participants a sense of identity and belongingness. Researchers have found that shared repertoire is developed and maintained through leadership. The connection between leadership and shared repertoire was clearly identified in Baker-Eveleth, Chung, Eveleth, and O'Neill's quantitative study (2011). Their work showed that the support and interactions by the leader had a positive effect on members of a COP' belongingness, involvement, and meaning. This resulted in innovative and active learning as the teachers developed a common set of resources. Likewise, a qualitative case study investigation of an elementary school teacher was performed to capture rich descriptions of informal leadership. Interviews and observations from twelve teachers revealed that all of the teachers provided leadership and expertise to the COP. The teachers produced a communal set of resources that they could use to support their practices. Most importantly, the teachers reported that they each felt they were part of making decisions and contributing to creating resources that were helpful to the group (Luebke, 2013). Creation of new knowledge is a key characteristic of communities of practice. In order for participants to develop a shared repertoire, everyone's skills sets must be highly valued. This results in participants feeling a sense of belonging and distributed leadership.

Discussion

Research in the areas of new science standards, problem-based learning, professional development, and communities of practice inform my study in several ways. These areas show

that there is a shift in how students and teachers learn. Science standards are changing to reflect a more student-centered classroom and problem-based learning approach. When it comes to problem-based learning, students are solving real world problems created to give them a context for learning. This informs my problem of practice because teachers need to develop the real world problems for their students to solve that revolve around their curriculum. If teachers do not know how to create these problems or design student-centered lessons, the Next Generation Science Standards might not be achieved. Thus, knowing that problem-based learning requires a shift in teaching, finding ways to provide teachers with professional development on PBL is imperative. Knowing that research describes professional development as shared and collaborative, I created a similar environment through a community of practice. Overall, these bodies of literature contributed to my study because I could make better decisions when I developed the community of practice focused on increasing science teachers' capacity to develop problem-based learning lessons.

CHAPTER THREE: METHODOLOGY

For the purposes of this qualitative study I used a case study methodology. In qualitative research, case studies are seen as an appropriate method for researchers that want to explore a phenomenon within its context using a variety of data sources (Merriam, 2009). Qualitative methods generated descriptions about participants' perceptions of the community of practice and provided insight into the model's strengths and weaknesses. The results from this study will be reviewed and utilized as a method for bringing new teachers into the profession.

Intervention

The COP involved experienced and novice teachers from multiple schools working together. The members met once a month after school hours to develop lessons, share ideas, and work towards mutually agreed upon goals. The common characteristics of effective COPs have been identified as (a) a focus on a common concern or set of problems, (b) sharing best practice, (c) collaborative culture, and (d) creating new knowledge (Lave & Wenger, 1998). Using these characteristics as a starting point, participants worked to create and share ideas on using PBL in their classrooms.

COP setting. During the 2013-2014 school year I was approached by four student teachers that had open-minded cooperating teachers who were unable to help with the implementation of PBL. To help these student teachers I met with them throughout their student teaching semester to develop PBL lessons. They found the meetings so helpful that they still continued to meet as a group to develop lessons. Since then the group has grown to include approximately ten new and experienced teachers who meet once a month.

For this study I worked with eleven teachers during the spring 2015 semester. The monthly meetings from January-April took place in my classroom located in central New Jersey.

The meetings lasted approximately two hours and included dinner provided by the researcher. Meetings were guided by agendas that were generated based on the results of feedback forms, reflective interviews, and reviewing previous meetings. The overall goal of the COP was to develop and foster collaboration among teachers from across the state of New Jersey. The COP has the following sub-goals:

- To help teachers develop the skills to implement PBL in the classroom.
- To develop PBL lesson plans.
- Develop and maintain a community of practice.
- To combine the experiences of master teachers and recently prepared novice teachers so that they can be helpful to each other.

First meeting. The first meeting began with introductions as a way to get to know each other, except Rich who came in late so he missed the introductions. I proceeded to explain the blog that I set up as a back channel. Participants were encouraged to use the blog to post questions or concerns in between meetings. I then spent time demonstrating a PBL by walking the participants through one as if they were my students. They watched a video plea for help from my high school principal who needed them to find the missing Knight mascot. The participants were then tasked with making a knowledge list. During this time teachers raised questions and concerns regarding the structure of initiating a PBL. The rest of the meeting was spent discussing the pedagogy of PBL. Participants voiced concerns and shared ideas from their own practices. In sum, most of the novice teachers were the ones raising the concerns and asking questions, and the experienced teachers were sharing their ideas. The meeting ended with the group deciding on a topic for a PBL to be created during the next meeting.

Second meeting. Evan joined the group as a late participant and so the second meeting began with brief introductions so that Evan would know all of the other members. He met everyone but Rich, who did not attend this meeting due to car trouble. We then moved on to looking through a Google Folder that I created and shared with the group. The folder contained sample PBL's, lessons, and other resources that were requested on the feedback forms. The participants had access to add files to the folder. After going through the files in the folder I started a Google Document in which all participants could collaborate. This document was used to brainstorm ideas for our first PBL. The participants agreed to work in 2 smaller groups rather than 1 large group, so I split the participants in half down the middle of the table. Most of the novice teachers were on one side of the table and experienced teachers on the other side. I was a participant in the experienced teacher group. During the brainstorming time each group added ideas focused on a learning objective about Heredity from the Next Generation Science Standards. The meeting concluded with the groups sharing the ideas they generated.

Third meeting. All of the participants were in attendance, except for Lisa and Rob. The third meeting began with dissecting a sample PBL that I put together. This PBL "package" contained everything I used for a unit on Evolution including instructions for students, the hook, authentic audience, rubrics and daily lessons. We spent approximately 30 minutes going through each page of the folder. During this time the participants asked questions and we discussed how this plays out in the classroom on a daily basis. The rest of the meeting was dedicated to brainstorming ideas for PBLs. I split the participants into three groups. Chloe, Kim and Tammy were grouped together because they all teach environmental science. Helen, Beth and Janice worked together because they taught middle school science. I grouped Stacey, James and Evan together because they taught high school biology. I did not participate in any of the groups, but

made myself available to help as needed. Each group selected a topic and worked on generating problems associated with the topic and potential authentic audiences. The groups put their ideas on large sheets of post it paper that were hung around the room at the conclusion of the brainstorming. Each group was then given colored post it notes and they walked around to each poster leaving feedback for the group. The meeting ended with a brief discussion about the process.

Fourth meeting. All of the participants were present for the final meeting. They were given an article about the seven essential components of PBL and we used the Making Meaning protocol from the National School Reform Faculty (2014) as a way to analyze the article in a structured format. I acted as the facilitator ensuring that we stuck to the order of the protocol, which was to first describe the text refraining from judgment and then ask questions about the text. We then speculated about the meaning or significance of the text and concluding with discussing the implications of the text to science education. We spent a few minutes reflecting on using the protocol. The rest of the meeting was spent on reviewing the problems each of the groups created from the previous meeting. As a large group we shared the comments on the post it notes and talked about ways each of the problems could be improved. The meeting concluded with all of the teachers working on developing lessons for the alternative energy problem created by the middle school group.

Sample

Twelve science teachers (myself as the researcher included), participated in the study after agreeing to the Institutional Review Board's (IRB) requirements. Convenience sampling was used because the sample was based on the group of teachers I was already working with while developing the statewide COP (Merriam, 2009). Some of the current members agreed to

participate in the study, but to find more participants I used a recruitment strategy. In order to recruit new teachers I advertised through an online newsletter through the Biology Teachers Association of New Jersey, which is sent to all New Jersey science supervisors. The aim was to have a sample of eight to ten teachers from across the state of New Jersey. The participants were life science middle school or high school teachers interested in implementing PBL in their classrooms. In addition, the participants were a mix of student teachers, novice teachers, and more experienced teachers. Pseudonyms have been provided to protect the identity of the participants. Background information about the participants can be found in chart 1 below.

Chart 1: Participants' Background Information

Participant's Name	**Years of Teaching**	**Grade level teaching**	**Science Currently Teaching**
Laurie	1-3 years	8th grade	General Science
Beth	1st year	7th grade	General Science
Chloe	1-3 years	6-8th grade	Environmental
James	1-3 years	9th & 12th grade	Biology & Marine
Tammy	1st year	9-12th grade	Forensics and Environmental
Kim	1st year	9th grade	Environmental
Helen	0- student teaching	8th grade	General Science
Stacey	0- student teaching	10th grade	Biology
Rich	Retired supervisor	Teaching teachers	NA
Janice	10+ years	7th grade	General Science
Evan	4-10 years	10th grade	Biology

There were two groups of novice teachers. The first group, which was the majority of the participants, was teachers with 0-3 years of experience. Of these eight teachers, Laurie reported having the most experience implementing PBL. The two student teachers, Helen and Stacey ranked themselves as not having ever implemented PBL and the other novice teachers had an average to below average experience with implementing PBL (First feedback form, January 2015). The final novice teacher was Evan who is an experienced teacher of 4-10 years, but reported to having very little experience creating PBL and almost no experience implementing it (First feedback form, February 11, 2015). Evan joined the group after the first meeting. Overall, Evan's contributions were very similar to those of the other novice teachers that had less teaching experience.

In addition to myself, there were two other experienced teachers in the community of practice, Rich who is a retired science supervisor and Janice who has 10+ years of teaching experience. Rich never completed the first feedback form so I do not know how much experience he has with PBL and he only attended half of the meetings as a passive participant. Janice on the other hand reported having quite a bit of experience creating PBL and implementing it and was at all of the meetings as an active participant. Overall, all of the participants reported having very little PBL training, with most of the exposure coming from pre-service education programs or from working with me.

Data Collection Procedures

One of the strengths of qualitative design is the ability to provide the reader with an understanding of participants' experiences (Merriam, 2009). In keeping with a case study design, I gathered information through multiple data sources including feedback forms, focus groups, observations, and document analysis. A qualitative inquiry approach requires an active and

involved role for the researcher. Chart 2 below details the relationship between the research questions and data sources.

Chart 2: Research questions and data sources

Research Questions	Data Sources
1. What takes place in the community of practice focused on creating problem-based learning lessons? a. How is the COP structured? b. What activities are teachers engaging in? c. How does the COP work when there are varying levels of experience among participants?	- Audio and video recorded observations of the COP - Document analysis of the PBL lessons. - Interviews
2. What are participants' perceptions of the value of the statewide community of practice? a. How do the participants describe the experience of participating in the statewide community of practice? b. What do participants say about the quality of the learning that occurs in the COP? c. Do participants believe that the COP impacted their teaching practice? If so how? d. How do perceptions of participants differ depending on their level of experience?	-Feedback forms via Google forms will be given to the teachers after each meeting to look at their perceptions of the meetings and to see how it is impacting their teaching practice. - Focus group will be held at the end of the four sessions.

Feedback forms. Four feedback forms were distributed to participants during the research study. Feedback forms were created using Google Forms and consisted of open-ended questions. Feedback forms were emailed to all participants after each meeting, utilizing their personal email addresses and required their name. Participants who did not respond received follow-up emails after one week of distribution, and again before the next meeting. Questions for the first feedback form focused on gathering information on the participant's years of teaching experience, current grade level they are teaching, experience creating and implementing PBL,

and collaboration with teachers in their schools/district. In addition, it served as a needs assessment to help plan the first meeting (See appendix A). The second and third feedback forms consisted of questions that focused on the following topics: participants' perceptions of the meetings, collaboration with members of the COP, the value and purpose of the meetings, and their perceptions of how the COP is changing the way they teach PBL. These feedback forms also included questions that would allow me to gauge their needs to inform the session agendas (See appendix B & C). The final feedback form reflected the same questions from the previous two forms, with the addition of two questions that aimed to get feedback on how COPs could be fostered within their schools (See appendix D). The questions from all the feedback forms were piloted with my dissertation group prior to implementation to ensure validity. Responses to open-ended questions were typed onto one document based on the survey question they addressed.

Informal conversations. Informal conversations are a vital way of gathering information from those experiencing the COP. As I was interested in participants' perceptions of the COP I wrote down any conversations that I had with them at the end of each session, during the breaks, and in between the monthly sessions. I asked permission to write down notes directly after the conversations. Immediately following each conversation, they were dated and organized by participant in Dedoose. I created memos in the margins of my text to indicate my feelings, reactions, hunches, initial interpretations, and speculations (Merriam, 2009).

Reflective interviews. I was interviewed a total of five times over the course of the research study. The semi-structured interviews were audio-recorded and I was interviewed before the start of the first COP meeting (January 4, 2015) and immediately after each of the four meetings (February 1, March 15, March 29, and April 26, 2015). Linda, a peer in my dissertation group, who has a similar background in professional development and teacher leadership,

conducted the interviews. She was given the questions in advance to prepare. Each interview lasted approximately 30 minutes.

Merriam (2009) explains that interviewing is necessary to capture non-observables such as feelings, perceptions, or how people interpret the world around them. Thus, the purpose of these interviews was to engage me in reflective conversations focused on my perceptions of the COP meetings. These conversations ended up being a key component to the structure of the COP. Since I was interviewed 5 times, I created five sets of interview questions. The first set of interview questions focused on my experiences and exposure with PBL, collaboration, and purpose for creating the COP. The next three protocols consisted of questions that aimed to understand what was happening during the meetings, including my experiences, the roles of the participants, and the strengths and weaknesses of the group. The final interview protocol contained questions about the overall experience. These questions were piloted with my dissertation group prior to implementation to ensure validity (see appendix G-J).

Focus group. Focus groups bring together a small group of people who have similar knowledge of a situation (Merriam, 2009). By bringing these people together they were able to discuss specific issues in a particular setting where participants feel comfortable enough to engage in a dynamic discussion. In doing so a focus group encourages a range of responses, which will provide a greater understanding of the attitudes and perceptions of the participants (Merriam, 2009). A focus group was conducted at the end of the spring 2015 semester with all of the available participants. The purpose of the focus group was to dive deeper into their thoughts on the benefits of being part of the COP and how it shapes their teaching practice. Additional interviews were conducted with the participants who were not able to participate in the focus group.

The focus group session and interviews were audio recorded. The focus group lasted approximately an hour and a half and the interviews lasted approximately 30 minutes. They were conducted about a week after the final COP meeting. The focus group was conducted in my classroom and the interviews were done over the phone. I used a semi-structured protocol to facilitate the discussions (See appendix E). Use of a semi-structured protocol allowed a more natural flow to the conversation, hopefully putting the participants at ease allowing them to expand on the responses of others. At the completion of the focus group and interviews immediately wrote a formal detailed description of the focus group session and audio recordings were transcribed and uploaded to Dedoose.

Observations. In qualitative research it is important to gain as much information as possible. Observations contribute to the depth of the data set by allowing the researcher to record information as it happens (Merriam, 2009). Because I was an active part of the meetings, in order to be able to reflect on and understand what took place during the meetings, I video-recorded and audio-recorded each of the four sessions. The day after the observation, I sent the audio recording to be transcribed. Finally, the transcription were uploaded into Dedoose and I wrote memos of my thoughts about what I saw happening during each meeting.

Field notes. I kept a researcher's journal to record field notes throughout the COP intervention. While I wrote in this journal at various times, I scheduled 15 minutes after each meeting to write. Field notes included my perceptions of the COP observations, reflections on the surveys, and my additional conversations I have with the participants outside of the COP setting that related to our COP.

Documents. In qualitative research, documents can supplement data gathered from focus groups and observations (Merriam, 2009). With this in mind, any documents used for the

meetings (such as agendas or protocols), and documents generated by the participants during the sessions were collected in Google Doc folder with the purpose of gaining an inside look into what the teachers were doing during the COP. Documents are like observations in that these documents can provide a snapshot into what I think is important, while observations allow one to see overt behavior (Merriam, 2009). In other words, documents can tell about the inner meaning of how the teachers planned and discussed problem-based learning lessons.

Chart 3: Data Collection Schedule

Date	Description of Data Collection Activity
January 3, 2015	First feedback form was emailed to participants.
January 4, 2015	First reflective interview.
January 29, 2015	First COP meeting.
January 30, 2015	Second feedback form was emailed to participants.
February 1, 2015	Second reflective interview.
February 26, 2015	Second COP meeting.
February 27, 2015	Third feedback form was emailed to participants.
March 15, 2015	Third reflective interview.
March 26, 2015	Third COP meeting.
March 27, 2015	Fourth & final feedback form was emailed to participants.
March 29, 2015	Fourth reflective interview.
April 22, 2015	Fourth & final COP meeting.
April 26, 2015	Fifth & final reflective interview.
April 30, 2015	Focus group.
May 1, 2015	Interview with Rich (not able to attend the focus group).
May 2, 2015	Interview with Kim (not able to attend the focus group).
May 12, 2015	Interview with Evan (not able to attend the focus group).

Data Analysis

Creswell (2009) reminds researchers that there are six steps for analyzing data. They are: (1) organize and prepare the data, (2) read through all of the data, (3) code, (4) develop categories/themes for analysis, (5) determine how themes will be represented, and (6) interpretation (p. 189). These steps will be explained in further detail below. To ensure validity,

findings were triangulated across the feedback forms, focus group/interview responses, observations, and documents, to make assertions about each participant individually and collectively as they relate to my research questions.

Organizing the data set. The initial step in organizing the data for analysis was to create files for each type of data. Since I was looking at the totality of the COP experience, all feedback forms, informal conversations, focus group interviews, observations, documents, and field notes, were imported into computer files and uploaded to Dedoose. In order to answer my first research question I began by organizing the data chronologically so as to describe what was taking place during the COP meetings.

Next, I reordered the data by participant to answer my second research question, which sought to describe the impact of the COP on the participants. Not only did I look at each participant's responses individually, but also I looked across participants. I continued rereading through all the data and added memos in the margins (Merriam, 2009).

Creating codes. The next step in my analysis was to create codes. To describe the data sets, I began by reading all the documents again carefully to gain a better understanding of the whole picture, and in doing so recorded ideas, notes, and observations that came to mind as it related to the research questions. I wrote memos to record thoughts about general ideas and my impressions of the overall depth and credibility of the information. I analyzed the data for preliminary codes and after peer debriefing with my dissertation group several times, I came up with a final coding scheme in preparation for identifying themes. As I worked on finalizing my codes, I created a qualitative codebook that helped me keep my codes organized. I made two coding charts, one for each research question. Included on the chart were definitions of codes

and excerpts from both novice and experienced teachers. I wanted to see if there was any difference between the two groups.

Developing themes. After my codebook was finalized, I sorted my data, using Dedoose, by code. This means that I took information from all the data and rearranged them in new documents by common codes in order for me to look at relationships and similarities in the data. There were nine codes in total, therefore there were nine documents of transcriptions that matched each code. I chose to start with a deductive approach and within each document I summarized the transcriptions looking for similarities and differences as they pertained to my research questions. To strengthen my summaries, I included direct quotations from the data. I continued developing these summaries by looking for more evidence to support my findings (Merriam, 2009). During the last part of data analysis I moved away from being descriptive to analytical. Digging deeper to find meaning in the data led me to six major themes, three that address the first research question and three that address the second research question.

Writing the report phase. I brought together my analysis by writing two case portraits. One portrait highlighted the structure of the COP while the other highlighted the impact of participants' experiences of the COP. I presented the data along with a narrative interpretation of the findings related to the research questions and the themes that emerged from them. In both cases, rich descriptions thoroughly portrayed the experiences and perceptions of the group.

Reliability and Validity

Using qualitative methods for this study presented issues of validity and reliability (Creswell, 2009; Merriam, 2009). In order to address these issues I took careful actions. First, it was important that the data set was accurate. I used member checking with the participants to determine the accuracy of the information I collected. Specifically, I gave transcripts of the focus

group interview and copies of the observations to the participants to ensure that I have captured the essence of the meetings (Creswell, 2009; Merriam, 2009). To help with internal validity I used multiple sources of data including feedback forms, focus group interview, observations, and document analysis. I compared different data sources in order to triangulate the data to see if the codes held consistency across all data sources.

When it comes to conducting observations, while the researcher has a first-hand experience with the participant, an observer cannot help but affect and be affected by the setting (Creswell, 2009; Merriam, 2009). After experiencing a COP with some of the participants in the past, I felt as though having a COP can impact their teaching practices. Therefore, to keep bias in check I used field notes to record observations and check in with the participants as peer reviewers (Merriam, 2009). Keeping a journal and writing memos gave me the structure needed to write reflections on my biases, dispositions and assumptions. Also, my research journal, memos, and noticings allowed me to keep an audit trail. In other words, I kept a detailed account of the methods, procedures, and decision points in carrying out the study. Overall, by taking my role as the teacher-researcher into consideration and keeping an audit trail, I enhanced the study's reliability.

CHAPTER 4: FINDINGS

The primary goal of this study was to examine the perceptions, experiences, and opinions of the participants in a statewide community of practice that focused on supporting teachers that were implementing Problem Based Learning (PBL). I will begin with an analysis of what took place during the meetings. In this section I will highlight my role as the leader, particularly how I met the needs of the teachers, how I shaped the flow of the meetings as both facilitator and participant. Everyone brought different components to the group depending on their levels of experience with PBL. I will proceed by discussing these contributions and how the participation of all the teachers led to a collaborative COP. I will conclude by examining the perceptions of participants in the COP, which includes what they thought about the COP as a form of professional development, what they valued about the meetings, the benefit of having teachers with varying levels of PBL understanding and teaching experience, and lastly I will discuss their perceptions of a need for a COP that is not tied to a school or district.

Building a COP

The purpose of the study was to consider how the community of practice model (COP), at the state level, used the expertise of both new and experienced teachers to create problem-based learning units. Ideally a community of practice is a group of people who share a similar craft or profession. They work to create a culture of collaboration, sharing best practices, and the creation of new knowledge (Cochrane-Smith & Lytle, 1999; Lave & Wenger, 1998; Wenger et al, 2002). As I endeavored to identify what was taking place during the COP with a focus on problem-based learning, I discovered a community of teachers who were willing to participate and who valued the experiences of others and used those experiences to guide the creation of new knowledge. The teachers were not being paid to attend, it was not a form of punishment, nor

were they being told to participate by their administration. When presented with the opportunity to participate in the COP they all agreed. As a result, I was able to lead the group because they were willing to let me lead them and during my analysis, my role as leader emerged as an important characteristic. The other major theme was that the teachers were able to create knowledge when they worked together which resulted in something greater than each of their individual contributions added together. My examination and interpretation of the data revealed the complexity of a voluntary group of teachers who appeared self-motivated to improve their craft.

The Structure of a Meeting

At 5:00PM, once a month, the teachers and I would sit around a large lab table in my classroom exhausted from a long day at work, laptops turned on, and the evening's agenda on full display. As I would press play on the video camera and voice recorder on my iPhone the teachers would start eating dinner and share stories from their classrooms and their personal lives. After a few minutes of eating and talking I would formally start the meetings by reviewing the agendas.

Behind the scenes, in between each meeting, I spent time reviewing data from the feedback forms. This data included their perceptions of the meetings and a brief needs assessment. Additionally, a peer in my dissertation group, Linda, interviewed me after each meeting. I structured the interview questions in a way that would allow me to reflect on each of the meetings. I spoke about what I thought was and was not working during the meetings. Linda, having a similar background in professional development and leadership, was able to offer me suggestions. For example, during the second meeting I randomly put the teachers into two groups to brainstorm ideas for a PBL. This resulted in one group creating more authentic PBL ideas.

While talking to Linda, I realized that most of the experienced teachers were in this group. I thought through some ideas with her about how to break up the groups ahead of time so that they would be more evenly dispersed. The combination of the data from the feedback forms and my own reflections informed each meeting's agenda and subsequent structure.

In addition to reviewing the agenda at the start of each meeting, I would also remind the teachers that these agendas were based on their needs. I wanted to show them that I was trying my best to meet their individual needs. The meetings would then proceed by going through the list of prioritized agenda items. During the meetings teachers would ask questions, share ideas, work in large and small groups, and made decisions along the way. The agendas were structured to be very broad which allowed for flexibility during the meetings. For example, they had time to work in groups to generate ideas for real world problems, but each group decided on a topic. As the meetings came to an end I would bring everyone back as a large group and summarize what we did, remind them to complete the Doodle Poll of their availability for following month's meeting, and to complete the feedback form that would be emailed. In the following section I will look at my role as a leader in shaping this community of practice.

My Role as a Leader

Leadership is an important part of cultivating and maintaining any professional learning network that hopes to further develop its members (Dufour, 2004). In reflecting on the meeting minutes I found that the group could be described as a non-hierarchical voluntary group, meaning that the leadership provided was not imposed from the outside, but emerged during the course of the work. The analysis of the data revealed that the structure and support that I provided to the community shaped the opportunities for learning. The findings described here highlight the juxtaposition of my leadership and the voluntary nature of the group.

Meeting teachers' needs. In examining the data, it became clear that a key part of my job in the group was to identify and respond to the teachers' stated needs. As a teacher, I have experience creating and implementing PBL. As the leader of the COP, I found that one aspect of my role was to listen to the teachers' needs and then use my own experiences to provide them with support and examples.

Since I only worked directly with one of these teachers, and the group had varying levels of experience, before the first meeting and then after each subsequent meeting, I sought out information on what the teachers believed they needed in order to create that week's agenda. For example, on the third feedback form teachers overwhelmingly indicated that the meeting would be improved by having access to a finished product from a PBL. Janice indicated that she wanted to address, "intro, and rubrics vs. checklists, progress tracking, concept tracking, and more" (March 11, 2015). I used this data to inform the meeting agendas and provide resources to the teachers. I put together a PBL "package" that I had created for my high school biology students on the topic of evolution. As part of this package, I put in all of the documents that I created including the presentation of the problem and the daily lessons. It also included rubrics for the students and the authentic audience, timelines, and checklists. Then in a subsequent meeting, we went through the documents and discussed a PBL unit from start to finish. I even made sure that the teachers knew that I was doing this in response to their feedback:

> Some of the issues that I saw in the feedback form were a lot [of you] still did not really understanding what the product would look like of a PBL. I put together a package of an example of one. A lot of things came up in the feedback form including how long does it take for these things, how do you assess, all those kind of questions came up. I try to put

> it all together in a pretty package so that if you had an idea you at least had a starting point to say this is what it should look like (Third meeting, March 26, 2015).

The PBL package that I put together for the teachers was a result of finding that they still did not understand the structure of an entire PBL unit. There was no one demanding that I stick to a particular agenda and this gave me the freedom to respond to their needs and requests. This was important because I was able to bring my areas of expertise together with their needs and provide the teachers with something that was usable.

In addition to using the data from the feedback forms, I found that my reflections after each meeting helped me to navigate the structure of the group. For example, I felt that the first meeting did not go as well as I planned because we did not generate any PBL ideas. I explained to Linda that the majority of the meeting was spent sharing experiences and talking about what we knew of PBL (Second Interview, February 1, 2015). During this same interview I discussed how I could improve the next meeting:

> I think I would try to do more of the creation of the PBL, try to pose more resources ahead of time for teachers to look at. We ended the meeting with everybody going around and talking about an idea of a PBL they wanted to produce, so I have that as a starting point. I think I may just try to change it so that there's more production in terms of making a product versus just sitting around and talking.

I found that the post-meeting interviews were a key resource to help me improve the meetings. Reflection allowed me to consider what went well and what did not go well in the meetings. As a result, I adjusted the following meeting agenda. I was not just reflecting on what happened during the meetings, but I was also putting together what I knew would help them from my experience of being a peer who understood their positions. I could call upon my own classroom

experiences being a practicing teacher coupled with my experiences implementing PBL. Taking a critical look at the professional development as it was evolving allowed me to adjust the meetings to better fit their needs.

Facilitation during meetings. My role as a leader was also evident throughout the meetings through my ability to moderate meetings based on what I believed was best for the group. Sustaining a community of practice involved deliberately creating boundaries in keeping with the goals of the group. The teachers were there to work on creating and implementing PBL so I wanted to make sure we were achieving that goal. For example, during the fourth meeting on April 22, 2015 we were working through a protocol to analyze a text about implementing PBL. I thought this would be helpful to the teachers because I noticed they were still struggling with understanding all of the components of PBL. One of the first steps of the protocol involved describing the text on what they saw while refraining from making judgments. While working through the text, Kim interrupted:

> Here's the question because I would love to do stuff like this. Sorry for the personal thing, but you say, 'meaningful to them,' how much of this is meaningful to them. My kids don't give a damn about the beach.

At this point there were at least two ways to proceed: let Kim continue or refocus the group. So I took control of the situation and said, "Okay. We can't make judgments." She tried again to inject her feelings by saying, "No, but my point is how did it make it meaningful to everyone? That's my biggest thing with this, because I think this is useful. I think this is not necessarily authentic to everyone." I remained focused on moving the conversation forward and said, "Tell me something that you see in the text." Kim and I clearly wanted the conversation to go in different directions. I wanted to keep the group focused on the protocol to describe the text and

Kim was thinking of her immediate needs and reactions. During this particular time, I thought it was important to stick to the protocol, as I did not want the conversation to get side tracked. Although the teachers were choosing to be at the meetings that were driven by their needs they still needed to have someone to move them forward and provide direction.

Regardless of whether they thought I was right or wrong in the decisions I made, the teachers appreciated that I kept the meetings moving. For example, although Kim and I may have not been on the same page in the workshop, in her final interview on May 3, 2015 she said: "I think you [Kristina] did a really good job of facilitating. You did not necessarily answer a lot of your own views into it, which made it easier for people to express themselves. For example, like you knew where you wanted the conversations to go, and there was really no motive." Although I was the one giving direction to the group, Kim clearly did not see it as coercive, but rather saw it as helpful. In fact, all of the teachers appreciated my attempt to keep the group focused. When asked to describe my role during the meetings, the teachers said I acted like a facilitator. Evan's comment highlights their thoughts best:

> You [Kristina] keep the agenda rolling. You keep the plan going and you don't let too much off the path behavior happen as far as the goal and you get stuff done. Here it seems like things get done the way we want (Interview, May 12, 2015).

In analyzing the meeting transcripts, I often found that the teachers were quick to become distracted from the task at hand, and that one of the more surprising aspects of my role was as the "topic police." Although the group was voluntary, and I was a peer as well as a leader, I found that I sometimes took on the role of insisting the group stay on task. For example, during the fourth meeting on April 22, 2015, the teachers were working on creating an alternative energy PBL and James, one of the novice teachers, proposed a large scale PBL with students trying to

make a school that is self-sustaining. Another teacher reminded him that the group had moved away from this idea. The conversation continued to go back and forth with the group trying to think about a problem on the topic of alternative energy. As the conversation continued, several members of the group began getting distracted by wanting to write a title for the PBL before even hashing out the problem. At this point I intervened and insisted that the group focus on finding a problem statement.

Laurie: I know, I know, but I'm just giving it a title right now. (*Excited*)

Rich: We got to get past the title. (*Frustrated*)

Kristina: I'm just putting energy. Okay, there you go. I just put it in just the regular one, just go to see… (*Appeasing*)

Kim: The PBL energy?

Kristina: The problem … I know you're writing something. (*Sternly*)

Laurie: I'm just… (*Excited*)

Kristina: The problem, what do we got? (*Sternly*)

Laurie: I'm going to do it.

Kristina: Do not do it. What is the problem? (*Sternly*)

After pushing several times to put other things in the document, I insisted she stop typing so that we could identify the problem.

James: Fossil fuels aren't unlimited. (*Matter of fact*)

Laurie: Yeah and the detrimental effect they have to the environment. (*In agreement*)

Kristina: Okay, so go ahead and write the hook. (*Relieved*)

James: You may now write the hook. (*Celebratory*)

James finally jumped in and established the problem. Laurie, still with her fingers close to the keyboard of her computer, quickly added her comment afterward. It seemed like she was agreeing with James to be able to move on to write the hook or entry event. While I understood that Laurie was excited to create this PBL because she loved the idea of hooking in the students by having them go without electricity for a day, I believed that protocol dictated that we start with the problem. Because the group had not established the problem, I felt it was premature to start writing other components. In this instance my leadership involved insisting the members of the group stick with the structure for developing PBL. While the group was democratic in the sense that there was no official institutional leader, there were definitive moments in which my role as leader shaped the conversation.

Missed opportunities for helping. Supporting teacher learning can be difficult, especially within loosely structured learning activities. After reviewing the feedback from the teachers, the meeting agendas, and my own reflections of the meetings, I found that I did not capitalize on every opportunity to help the teachers. For example, while working through the structured protocol during the fourth meeting on April 22, 2015 Kim was trying to figure out how to use PBL with her students. As seen in the previous section, instead of addressing her questions I made the decision to keep with the protocol of describing the text. While using the protocol forced the group to stay on task it also resulted in missed opportunities for addressing the teachers concerns.

After reviewing the feedback forms in conjunction with the agendas I noticed that I did not fulfill all of the requests made by the participants. In the second feedback form on January 30, 2015 James wrote that he wanted to work on “exploring standards based grading if it’s not too far off topic.” On the same feedback form Kim also wrote that she wanted to learn more

about “student questioning techniques” (February 10, 2015). Teachers identified other topics outside of problem-based learning that they wanted to learn; however, they were not addressed during any of the meetings. Similarly, some of the teachers also indicated that they wanted to discuss the day-to-day account of PBL, meaning how it plays out in the classroom on a daily basis. Beth’s comment on the last feedback from captures the teacher's request when she said, “You establish what you need to learn through mini-lessons at the beginning, but where will they fit it? How many days should a teacher go before presenting another mini-lesson” (March 28, 2015)? Even going into the last meeting the teachers were not confident on aspects of PBL implementation. I missed an opportunity to try and help them during the last meeting because I only allotted for half the meeting to be used for planning and creating the daily lessons in a PBL unit.

Lastly, I missed an opportunity to help the novice teachers understand how we brainstorm real scientific problems. During the second meeting I randomly put the teachers into groups by forming an imaginary line down the table to split them in half, which resulted in the experienced teachers working in one group and the novice teachers in the other. In the reflective interview with Linda on March 15, 2015 I told her it was not until I was “looking at the Google Doc as we were brainstorming” that I realized what I had done. “My side of the table is putting together all of these ideas about the Toms River book and curing AIDS…then I see the other group, and they’re writing about pretending to be a Genetic Counselor.” This resulted in the experienced group brainstormed real world problems and the inexperienced group had created a fictitious problem. The novice teachers missed the chance to hear the conversation that led to the group’s list of real world problems.

Contributor. Throughout my analysis, I found myself in a dual role. I was not only the facilitator, but contributed as a participant too. During the meetings I offered ideas and suggestions that came from my experience as a practitioners. For example, during the second meeting on February 26, 2015 we were brainstorming problems associated with protein synthesis, specifically how the body makes proteins. Some of the teachers suggested ideas like having the students pretend to be genetic counselors and creating public service announcements to bring awareness to Sickle Cell Anemia. Realizing that they were not proposing problems but rather contrived ideas, I brought up the discovery of the Delta 32 mutation. People having this mutation cannot get the HIV virus. So I proposed the problem: "In light of this, how can we use this discovery to cure AIDS?" As you can see from the example, my suggestion was based on a real-world problem, which is a key component of PBL. By participating during the brainstorming, I was able to model how scientific discoveries can lead to PBL ideas.

In addition to modeling how I generate ideas for PBL, I participated by offering ideas and suggestions while the teachers were discussing the implementation of PBL. For example, during the third meeting on March 26, 2015, Chloe, Kim and Tammy were discussing the struggles they had with engaging their students. Kim, in particular, shared an example of a project her students completed in which they had to pick a particular organism, count the number they saw in a particular area, and then using calculations figure out if the organisms' numbers were on the decline. She said that some students created "fun presentations", but most students "did not seem motivated to complete the assignment." The example Kim offered from her practice had students creating an artifact about the variety of different species of plants and animals in New Jersey to determine if their numbers are of significant concern. She was struggling to engage them with the project. I jumped into the conversation to offer some help:

> What I've seen regardless of the problem is [that] with an audience when they have to actually do it for that person then it's like the 'oh, no' factor comes in. Like, 'Oh, do you mean I'm really going to show this to my parents? Oh, you mean I'm really going to present this for the board of education?' They'll step up their game.

In my response I was trying to show Kim, based on my own experiences, the value of having students solve the problem for people who would care about the solution. Once they realize someone else is going to be evaluating their work, they become more invested in the work. I followed by sharing some suggestions on how they could find an audience by using social media tools such as Skype Classroom, which allows you to put your information in and say, "I'm looking for, and they send it out in their Skype universe and bring the people back to you." This example illustrates my ability to quickly respond to conversations when I thought the teachers were struggling with PBL by offering solutions that were based on my experiences and were practical solutions that could be used immediately by the teachers.

To summarize, my leadership was key in designing a statewide community of practice. As the organizer and designer of the activities, I was responsive to the teachers' needs when creating agendas for meetings and during the meetings. I was also willing to confront behaviors that appeared to conflict with the goals of the group. While I was the facilitator I also participated and because of my experience I offered more useful ideas and suggestions. This combination of roles provided structure while supporting full participation and responsibility on the part of the group. In the next section I will show how the other participants took responsibility for the groups learning.

The Whole is Greater than the Sum of its Parts

According to Lave and Wenger's Legitimate Peripheral Participation (1991), newcomers to a community of practice often only participate in low-risk activities as a way to get involved. Typically, new members, in this case novice participants often take a back seat to the more experienced teachers. This was not the case in our group. In the first part of this section I will examine how novice teachers were full and active participants, specifically how they worked alongside of experienced teachers to contribute to the collective knowledge of the group. Additionally, they all collaborated on creating new knowledge. In fact the value of the group as a structure and an idea turned out to eclipse the efforts of the individual members.

Contributions as individuals. All of the teachers were committed to helping each other by offering ideas and suggestions from their own experiences. This resulted in a shared repertoire of tools, including examples of PBLs from practice, resources, and ways of addressing problems. Although they took collective responsibility for the exchange of knowledge they all had their own unique ways of contributing to the process. I found that they were contributing when it was needed and they were responsive to each other's contributions.

Examples from practice. The teachers often contributed to the conversations by sharing examples from their own practice, such as a PBL that they tried with their students or digital resources they use to support PBL implementation. One way to think of this is that they contributed content to the meetings by bringing the group concrete examples from their classrooms for us to respond to. For example, during the second meeting on February 26, 2015, while the teachers were brainstorming ideas for PBL the following dialogue was exchanged between novice teachers and Janice, who is an experienced teacher. The conversation began with Chloe, Laurie, and Tammy, three novice teachers, sharing their experiences with developing a PBL around nutrient cycling.

> Chloe: If we want to do what you're suggesting, if we do nutrient cycle, some people can do nutrients, and some people can do pollution, so two aspects of that, if you guys are interested?
>
> Janice: Okay.
>
> Chloe: Because that's another topic that's listed on there.
>
> Janice: I'm game.
>
> Chloe: Okay let's do something.

As this conversation begins, Chloe suggests that the group work on developing a PBL for different aspects of nutrient cycling as it was a topic that was common for all the environmental teachers. Tammy responded by sharing an example from her own attempt to create a PBL on the nutrient cycle in her classroom:

> I just finished up nutrient cycling but what I did was actually pretty good. I mean it wasn't great, but it was pretty good. I found this website that has some modeling activities with nutrient cycling and then what they're currently doing right now is they're taking...I have a list of misconceptions, common misconceptions. It's a little not as advanced as some of the other PBLs but I thought it was a good jumping point.

The teachers wanted to figure out which way they should go during the brainstorming. Tammy was responding by trying to address the immediate needs of the small group. She followed up by saying, "which I can share it with you if you're interested." Tammy proceeded to upload the document into the Google folder that was shared with everyone. As a novice teacher Tammy did not wait until she had a deeper understanding of PBL to share with the group. She felt comfortable enough to jump right in and participate.

In reading over the examples of PBLs that were described by the teachers, I found that the experienced teachers also shared examples of PBLs from their own practices. These examples varied in depth and breadth. Some highlighted an authentic audience, some highlighted the creation of the problem, and others highlighted the pedagogy. Interestingly enough, I found that bringing in of these examples resulted in what is described as "just-in-time teaching," meaning the stories were told when the other teachers in the group needed to hear them. For example, during the second meeting on February 26, 2015, Laurie, a novice teacher, brought up a struggle she had with PBL related to audience. She was particularly concerned, that PBL expects that teachers are going to use an authentic audience, meaning a group of people or person that has a stake in the solution. Janice quickly jumped in by sharing an example from her classroom when she was trying to find an authentic audience during a PBL about soil in the National Parks:

> So the kids would email the park rangers because we were always doing the research not in the busiest time of the year for national parks. It wasn't summer. Kids would either send emails, or they would be able to get through on the phone, but often [they would get] emails back from park rangers. And after a few years of an entire 7th grade, various kids emailing park rangers, all of a sudden, the information started showing up in the nps.gov site because I guess they go, 'I guess people really care about this.'

In this example, the authentic audience to which Janice was referring was the park rangers. The park rangers were identified by her students as the ones that would be interested in and affected by their solutions. Laurie said it was "very cool" and "liked that the students took the initiative and were able to generate their own authentic audience by reaching out to people outside of their school." In this instance Janice used her experiences implementing PBL to share a story at a

moment when one of the other teachers was expressing some frustration. Her example of success appeared to be motivating to the group.

Responsibility for own learning. During the meetings all of the teachers contributed to the discussions by sharing resources when they found it to be helpful. For example, during the fourth meeting on April 22, 2015, Tammy, a novice teacher, was telling a story of how she was going to engage students during a lesson on alternative energy:

> All this week we've been talking about dirty sources of power so we're going to segue into talking a little bit about Hurricane Sandy. I have some pictures of charging stations that people set up, and there is actually this one charging station that a guy was powering with an exercise bike, so I am pretty excited about that.

The conversation continued when novice teacher Laurie chimed in to offer a suggestion:

> There is this company called Uncharted Play. Have you ever heard of it? The item is a super expensive prototype but it is about how do we get kids in Uganda that have iPhones but don't have electricity. The first product was called the Soccket Ball, and it is a soccer ball that has a motor in it that as you kick it around and it is turning, it is actually creating electrical charge so then the kids can plug their iPhone into it and it works.

As you can see from Tammy's comment, she was originally going to hook her students by showing them alternative ways to charge their phones by showing a picture. Laurie was then able to provide a resource she felt would help address Tammy's need to engage her students because it was an organization that was using play to generate electricity. Tammy immediately responded by saying, "This is cool. I'm going to show that to them." She also followed up by searching the company while on her computer. Looking beyond the scientific content, I see that the novice teachers were suggesting resources that they believed would be helpful to each other. Tammy

already had a way to engage her students, but Laurie's suggestion was a way for Tammy to enhance engagement. In fact, most of the teachers reported over multiple feedback forms that the shared resources were very valuable.

The teachers also shared resources as a way to support aspects of PBL. The data revealed that the teachers took responsibility for helping each other. An example of this occurred during the third meeting on March 26, 2015, when Beth and several other novice teachers were trying to figure out how to manage a student-centered classroom. Janice offered a blended learning platform to help with workflow:

> Using Google Classroom, I recommend doing it that way because then when they click on it, it's their copy. Then you still have edit rights and they have edit rights. It's better than making anything a new copy. If you're using Google Classroom or piloting Google Classroom, the best thing is to upload your template as a file. If you upload it as a template, then once they click on it, it's their own. They don't have to make their own.

Janice did not just offer the suggestion of a blended learning platform, but she continued on to explain in detail why it was preferable. In fact, in response to novice teachers' questions, Janice continued by letting them know how to use the features when she said, "You have to categorize it as something that automatically copies to each folder. Check off a box." Janice took the time to make it clear to the novice teachers why this was the best way to manage the flow of documents in a student-centered class. It appears that some of her suggestions spoke to the novice teachers because they began asking questions. This was not done in a big professional development where someone is up in the front of the room lecturing at them about Google Classroom. The resources that teachers provided were an important contribution because they came out of the conversation and came from them. In this way the teachers took responsibility for their own learning. All

together the group collaborated to create a resource rich environment to make sure everyone had what they needed.

Safe environment. The COP was a place where the teachers did not need to know everything and they felt comfortable enough to ask clarifying questions. They were able to interrupt the discussions and were not ridiculed for their questions. For example, during the first meeting on January 29, 2015, I shared an example of a PBL I did with my Forensics class to demonstrate how I introduce a problem at the beginning of the unit and have students figure out what they need to know in order to solve the problem. Novice teacher Kim eagerly jumped into the conversation by asking a series of questions. She started by saying, "One, so you're basically saying you're going to have the evidence ready for them?" To which I replied, "Everything's already done." It is clear that she is trying to figure out how to plan a PBL. She continues by asking, "Two, because that's I think most people's worry, what if your kids go a different way? Most of the time yes, it should be that way, but you're limiting them by going no, no, why don't we steer this way." I responded by saying, "I usually don't. I usually give them the opportunity to go however they want to and that's the best part of it. It's what I've found. Letting go of control and being a facilitator, rather than being in charge." The conversation continues and it appears like Kim was still trying to make sense of implementation.

Kim: Right, right. My point is though what if they go a totally different way?

Kristina: That's fine.

Kim: What if you don't have the evidence? Will you just make it up?

Kristina: Yeah. Then the next day I'd make it up and have it ready for them.

Kim: What if it's equipment you don't have or something that's just not easily acquired? Like what if they wanted to have DNA evidence?

Kristina: I'd say we just don't have the evidence. We don't have it…

In this example, Kim's questions show me that she was scared of not being in control of her class and not being smart enough in front of her students. She was concerned and my experience allowed me to alleviate her concerns. I responded to all of her questions without passing judgment on her or the types of questions she was asking. It appears that she felt comfortable enough to continue asking questions when she did not understand something.

In another example, during the fourth meeting on April 22, 2015, I was discussing how I felt that many teachers think they are doing PBL, but that having students make a poster or present on a topic that they researched is not PBL. This led James to ask, "So taking a project that is simply busy work and making it meaningful to students, how do you cross that line?" He was inquiring about having students do a project for the sake of giving them something to do versus making it relevant to the real world. At this point in the conversation, Rich began discussing UBD (Understanding by Design), which is a way of planning curricula that focuses on teaching for understanding, and starts with the end goal in mind (McTighe & Wiggins, 1988). Rich reminded James to avoid being an "activity designer", meaning creating lessons only because they are fun and interesting or giving tests based on the content taught. Instead he wanted to make sure they were focusing on keeping "the end in mind" and "creating assessments that really get to the core, the essential questions, and the big ideas." Rich is telling James that if he is giving students a problem to solve, then they have a context for learning and the activities become meaningful. James followed up by saying, "that makes sense, inquiry versus hands-on activities." James was not afraid to ask questions that show he may not understand how to make the shift from a traditional approach to a more student-centered approach. Rich was able to provide support by reminding the teachers of the purpose and importance of using PBL.

Collaborative efforts with varying experience levels. As I showed in the previous section contributions were made by both novice and experienced teachers. In addition, each teacher brings a different set of skills to the group. When all of the teachers collaborate together, it makes for a much richer experience. To demonstrate the ways in which the group was collaborative I wanted to highlight what happened in the final week of data collection. The teachers spent the previous meeting developing examples of PBLs, giving each other feedback, and then talking about them further. I wanted to share them because they show some of the ways in which all members of the group, including me, participated in creating an environment in which the group could construct new PBLs.

Shared contributions. Based on the meeting transcripts, I found that the brainstorming sessions were collaborative and were generally not dominated by just the experienced teachers. An example of this occurred during the fourth meeting on April 22, 2015 when trying to generate problem for the topic of Genetically Modified Foods.

Kristina: What is the problem with the fear of GMOs? (*Curiously*)

Laurie: I don't know. It's weird, but I think people don't understand what actually constitutes a genetically modified organism. Intentional selective breeding is technically a GMO. The strawberries I buy at Wegmans are GMOs because it is like, take the best of the best, mix them together, versus I'm splicing out DNA from this one thing and putting it in another thing.

Kristina: People aren't even familiar with selective breeding.

The conversation began with raising a question for which Laurie responded by sharing her own experience. This made me realize the problem was not about the fear of GMOs but that people are not knowledgeable, to which Laurie responded, "Maybe it's more like an awareness. You

want to throw around, 'I'm so ecofriendly, I'm so healthy because I don't eat GMOs.' Do you even know what GMO means?" I then brought up the controversy surrounding GMOs in European countries:

> I think that's part of the issue is that when we talk about why European countries...these people are protesting like crazy in European countries, 'No GMOs. Stop GMO,' everyone is hating on Monsanto and there is like this whole, especially in the EU, it's a big deal, and part of the problem is that people just aren't educated to know what they are and what they could do.

At this point in the conversation Rich jumped in to add his point, "Why [do] some GMOs have a negative component to them, that's the problem, there is misunderstanding. One paint brush is being used to paint all GMO." I added, "How do you educate people?" To which Rich responded "authentic audience, everybody." As you can see in this exchange no one person came up with an answer to our question. We collectively got to a point where we realized the problem is how do you educate people on GMOs. This exchange between Laurie, a novice teacher, Rich and myself, both experienced teachers, shows that we were all coming up with ideas about problems with GMOs by taking turns and listening to each other. Laurie felt comfortable to jump into the conversation to help the group tweak their problem. In this type of environment there were moments when the level of experience did not preclude anyone from participating in making meaning.

Democratic decision-making. Throughout the knowledge creation I found that the teachers moved forward based on the consensus of the entire group. In other words, the teachers had input during the meetings and we made decisions when the majority of the group was in agreement. This looked like one of us sharing a thought or idea and the rest of the group

commenting. For example, during the last meeting on April 22, 2015 the entire group was giving feedback on one of three problems generated by small groups. Janice raised an interesting point about the feedback being given to the environmental science group on their global problem of fossil fuel usage and alternative energy:

> So maybe it's not 'How do you make a house like a tree?' but the problem could be for middle school, at the middle school level, something about a significant change in their lifestyle that they want to make that could be within the grasp of what they are able to do and then they have to actually do it. Right there, the audience is their family, their community, whatever it is, and it can be personal to their house. It can be personal to their community, whatever it is, to actually make a change and follow through.

Janice shifted the conversation from trying to generate a global problem to a local problem in which the students could make a personal connection. After some back and forth discussion about ways in which students would feel personally connected to content, Tammy proposed the following idea:

> No lights, no computer. You'd have to have some books available. Then the students would say what's the deal? Do we get a movie today? And it's like, No! Sorry, no more electricity.

Janice got really excited about the idea of having students go a day without electricity. She said, "This is developing into a pretty interesting cross-curricular. I've been looking for some good ones. I'm starting to dig this." At this point all three groups received feedback from each other on the real-world problems they generated so I interjected to figure out where the group wanted to go next:

> So why don't we do this? It seems like we're at a good spot in terms of...so some of the things that...again, the feedback forms suggested that you wanted to work on timing and then these sort of introductory pitches, scenarios. Some people wanted to create documents for this. Some people wanted to brainstorm new PBLs so you guys tell me, now, based on what we're doing, what do you guys want to do and how do you want to move forward with the rest of our time today? Do you guys want to split up into two groups, the tree group and the GMO group? Do we all want to work together on something?

Knowing that the teachers had different needs and wants I proposed different options to the group for the next step. The result of which is the following conversation.

> Laurie: I want to create this. (*Enthusiastically*)
>
> Helen: I was thinking that too. (*In agreement*)
>
> Tammy: Yeah, this is kind of awesome. (*Enthusiastically*)
>
> James: I am interested in doing that. (*Enthusiastically*)

What is hard to illustrate in the text is the enthusiasm they all had for working collectively on this problem. As you can see from the end of the conversation they came to the decision that they wanted to work on developing one of these problems together as a group. They made a collective decision on how they were going to move forward.

In summary, the teachers took responsibility for the group's learning. Regardless of the experience level, all of the teachers were full and active participants. In bringing their own experiences to the group they were able to develop a shared repertoire. Building a COP also involved creating a safe environment in which the novice teachers were able to jump right into the conversations and all the teachers were able to ask questions. In addition, they provided

support for each other. In addition, their combined efforts resulted in the creation of new knowledge.

Participants' Perspectives

Overall, participants report positive experiences during the community of practice. Although the responses were similar in nature, the teachers also each had their own perspectives about aspects of the COP. This may be because of the different backgrounds the participants bring to the group. For example, the teachers are not only coming with different experience levels, but are coming with different district experiences. Three themes emerged from the analysis of the feedback forms and interview comments. These three themes are: (1) supportive, (2) diverse collaboration, and (3) the need for the support. This section describes each of these themes as it relates to how teachers feel about participating in a statewide community of practice.

Supportive

Creating opportunities for teachers collaborating and talking about their learning and practices outside of their district is vital to their professional growth because they are not always able to receive it at the local level (Garet et al, 2001). As it relates to my study, the participants found value in talking about their learning and practice outside of their district. James's statement sums up the teachers feelings as he said, "Simply being around and sharing ideas with others that have a progressive outlook so that I'm not working alone in my building is beneficial (Second feedback form, January 30, 2015). More specifically, participants valued the COP because (1) they were amongst like-minded peers, and (2) they viewed it as a quality learning experience. The findings described next highlight their perceptions of the advantages from participating in the COP.

Birds of a feather flock together. A majority of the teachers said that being among like-minded teachers, who were coming from a similar perspective, pushed their thinking. During the focus group on April 30, 2015 the teachers were asked to share how they would describe the community of practice to someone who was unfamiliar with it. Two novice teachers shared that in particular the group provided support when they did not feel like they were getting it elsewhere. Laurie started by saying, "I think it is a support system. Especially in times and days of frustration when someone wants to tell you that you are doing the wrong thing." James added to her point:

> I think especially when you are in a district where you may be the one who is the most forward thinking you kind of don't have the support or someone to measure up against. Like you said [Janice] setting the bar higher. What's the Biology Principle? Is it the Red Queen Hypothesis? When one species drives the other to become more and more. I feel like that is what is going on here.

The Red Queen hypothesis is an evolutionary hypothesis that proposes that organisms evolve together to reach a balance. In other words, James is saying that the group provided positive competition. It was not competition from thinking someone is trying to do better than you, it is competition that pushes you to do as good as someone who is doing it well. Chloe added that she would define the COP as an "extended professional learning community that works together to create authentic problems that can be used in our classrooms." At this point Janice says, "and to share skills." Then she goes on to share the value of having access to Chloe, one of the novice teachers, talents.

> Janice: You [Chloe] are really skilled at authentic problems and that pretty much blows me out of the water. Every time you talk about another thing you did I am like oh my word. I think you raised the bar for me.
>
> Chloe: Thank you.

In this example, experienced teacher Janice was encouraging of Chloe, who was a novice teacher, and she was also expressing her gratitude for the impact this had on her. What seems important to note is the appreciation being given to a novice teacher. Janice pointed out that being in the COP with Chloe was inspirational and pushed her to go further in her own practice.

Looking across this entire conversation the teachers reported several kinds of encouragement besides being inspired by each other's work. They felt that they were being cheered on during periods of frustration and just being around like-minded teachers was encouraging. In addition to providing evidence for the value the teachers gave to the group, this exchange exposed that the teachers expressed this was unlike their experience in their districts.

In others shoes. Most teachers reported that they felt the teachers in the COP understood their struggles. Their comments show that they appreciated the emotional support they received from the group. An example of this appears in Tammy's statement when she explained how she feels when working with the teachers in the COP:

> So there are people in our group that don't have the same support from their supervisors and from other teachers and it is nice to be able to unify on a common group here so that you have support and equal footing to step on because it is really difficult going up against the anti's by yourself (Focus group, April 30, 2015).

The last part of Tammy's comment indicates that she feels like she is fighting an uphill battle with her colleagues, but that she appreciated being with others who understood her situation.

In addition, the teachers reported that they were able to identify with other members of the group. For example, Stacey was able to relate with the experienced teachers when they discussed concerns of implementing PBL for the first time. In her second feedback form, on February 1, 2015 she said:

> The COP has been extremely informative and thought provoking so far. Being a new teacher, I like hearing the experiences veteran teachers have had with PBL. I find a lot of my fears and worries with PBL are actually similar to the ones the veteran teachers discussed in our first meeting.

This type of support goes beyond just being around like-minded people. The teachers appreciated that they were able to connect with each other emotionally. Overall, the collaboration in the COP had a positive impact on the teachers because they were all able to support each other. They could all relate to each other's feelings and experiences, which provided a safe place for the teachers.

Quality learning experience. Overwhelmingly, the teachers agreed that they benefited from working with each other. Beth, a novice teacher, shared her feelings about the value of being part of the COP. "I honestly love coming to these meetings because you do get so much valuable information and not just from one person it is from a whole bunch of different people" (Focus group, April 30, 2015). Beth's comment was in response to others discussing professional development and all of the teachers agreed that this collaborative group was a great experience. In fact, during an interview with Evan, an experienced teacher, he went so far as to say:

> This is probably the best professional development I have ever attended in my six years of teaching. Usually these [kinds of] meetings get side tracked and people start complaining and getting sidetracked talking about what is wrong with their districts and

> whatever. It is very on task and an excellent source of collaboration statewide. It is definitely very helpful (May 12, 2015).

The teachers reported feeling that they gained a network of teachers that are trying new things. Unlike the PD experiences reported previously, the teachers found the COP to be collaborative and productive.

Gained confidence. For the most part, the teachers' responses indicated that they felt optimistic about implementing PBL after participating in the COP. Their comments show that they are going to make changes in their own practice. For the teachers that are already implementing PBL they feel like they have more guidance to improve implementation. As Chloe said in the focus group on April 30, 2015, "I have been doing problems, but what has helped me here is focusing on is, is that really the problem? Focusing in on the real problem I think is where I have benefited." Tammy added by saying, "I think the PBL's that I am producing now I am much more proud of than the ones I have previously made even last year in your [Kristina's] class and in the beginning of the year. I think I am adding in a lot more components to it that I was lacking before." As a result of participating in the COP the novice teachers already implementing PBL feel that the information discussed during the meetings was useful to their practice.

In summary, the teachers' perspectives on the collaborative nature of the COP indicated that it was a valuable experience. The group provided support that was motivational and inspirational. In addition, they saw the COP as a safe group of teachers that understood their feelings. This resulted in the teachers feeling confident about implementing PBL and I found that regardless of the experience level all of the teachers seemed to like that they learned from each other.

Diverse Collaboration

It is typical for there to be experienced and novice science teachers working together within departments, schools, and even districts; however, it is quite another thing for teachers from different schools and districts to collaborate in a community of practice. Based on the feedback from the teachers, it seems like they had not thought of collaboration at the state level. Janice's comment sums this up, "I hadn't considered collaboration with teachers outside of our school district" (Second feedback form, February 10, 2015). As it turns out this atypical experience allowed for collaboration on a more diverse level then collaboration within district or school. I will begin this theme discussing how teachers developed new ways of seeing as a result of working with such a diverse group. Next, I will discuss the challenges teachers thought the diversity would pose and how coming together changed their perspectives.

Melting pot. Overall, the teachers reported that they benefited from working with others from across the state. They were able to hear stories from teachers in other school districts. Helen, who was doing her student teaching in a middle school 8th grade science class, was implementing the same curriculum as Laurie and I. During the focus group on April 30, 2015 she discussed having the unique perspective of seeing multiple approaches:

> I think different schools have brought a good perspective to me. Being at a school that is doing the same curriculum I get to see how it is being done differently because we met as an 8th grade science department once a week. We just started actually at Grover and seeing that there are four teachers over there with four different styles that are not this at all so that realizing that there are so many ways you can go about doing things and trying to bring back some of the ideas that we have here to Grover has been really interesting

> for me as a student teacher to provide new ideas. I think it has been a cool learning experience.

Helen was able to see different approaches to teaching science and the ones in her school were different from what was being discussed during the COP. The teachers not only bring their own personal experiences and knowledge base to the group, but having the diversity of teachers from different schools and districts expands the range of possibilities.

Similarly, the teachers spoke about working with others that taught different science content areas. This was not brought up as a concern during the meetings but they did talk about it during the focus group on April 30, 2015. For example Beth said:

> I know we talked about this earlier but in the beginning we did not know each other so I think it was more difficult to say well you're just a biology person so you're not really going to understand. But as we talked we have developed more of a relationship with one another where even though you have a bio or environmental background you still understand what we are talking about and say okay here is an idea for this and I think we are more willing to give suggestions to other people at this point in time.

The teachers may have been hesitant working with each other in the beginning because they taught different science content areas. Over time they became much more comfortable to help each other regardless of content area.

Not all of the teachers expressed complete satisfaction with the diversity. During her post study interview on May 2, 2015, Kim raised a point that sometimes having people who knew each other may have inhibited the group:

> I think it’s interesting a lot of you guys know each other, which, it’s good to work with people you know, but it’s not necessarily beneficial to the overall group. I think it would

> have been way more interesting to have random people from random schools, because everyone came to be with you, but I know a lot of people didn't know each other, so there were a couple from here, couple from there, you know what I mean? I feel like it, while it brings a certain level of comfort in the discussion, I feel like the conversation is completely different when it's completely random strangers.

It seems like Kim was trying to say that the group was not diverse because many of the teachers knew each other and thought it would be better if the teachers did not know each other. She was not able to elaborate on the benefits for doing this other than the conversations would have been different. At the end of her comment she does say there seems to be a certain level of comfort to the discussion when there is familiarity. I am not sure if she did not want to offend me by saying more about her feelings but it seemed like the diversity did not meet her expectations.

PBL transcends socioeconomic divides. The diversity in the COP was more than just novice and experienced teachers. It brought together teachers from districts where PBL has gone on for a while and districts that have not done it before. In addition, there were teachers from districts with high socioeconomic status (SES) and teachers from districts with lower socioeconomic status. During the focus group on April 30, 2015 some of the teachers grappled with others not being able to understand their situation. Chloe began the conversation by saying "I think at times it's a little tough because some schools can be so different and the kids can be so different at other schools. But I love it because I get to hear how different things work at different schools and see if it could work at my school and just learn new things." Coming from a district of lower SES, Chloe felt as though the other teachers might not understand the difficulties she has with her population of students. Stacey, who also taught at a less affluent school chimed in by saying:

> I can definitely speak to it being tough. Being where I am now I have kids in a completely different spot than most of the kids that like go to West Wiser for example, because that is the majority of the population here. For me a big challenge was how do I motivate students where their motivation levels are already low. I get students coming in everyday saying I came to this school so I don't have to go to college and I can get my certificate and I don't need to do any school work because I just need to get my certificate or whatever. So coming from that level even when you are doing like genuine problems that speak to them or even finding genuine problems that speak to them is also definitely a challenge. It is definitely a very different place coming from that with low motivation where in other places it might be a little higher because that is just the expectation of that district.

Stacey and Chloe can sympathize with each other because they work in schools where, in their opinion, the kids are not as motivated. They also felt like the teachers who work in higher SES districts would not be able to relate to their situations. The conversation takes a turn when Laurie jumps in to offer her opinion of working in a district where the kids are more privileged. She says, "Just like in the way you say it is hard to get your kids motivated in a way or interested in learning in general I feel like for a lot of us it is hard to get them focused on something more than what do I need to memorize and tell you that I know." Laurie feels as though her students are also unmotivated but in a different way. Up to this point in the conversation the teachers appear to be making assumptions that their students are not engaged in the learning process. Stacey then recognizes Laurie's perspective as the "other end of the spectrum" and Laurie goes on to discuss how PBL would help to motivate her students:

> So we in other ways deal with the extreme...Even if they don't find the authentic problem interesting in order to solve it they have to learn. So if nothing else it may keep them a little more focused in class even if it is just one or more days because I need to know this in order to do this big project. Even if they are just thinking in terms and not truly buying into if I create this really great plan it might get done. If they are not sold on that at least if they are motivated by the grades they care to learn the materials because they know they will need to know it to solve their problems. Not just I can go onto her website and memorize a PowerPoint and get an A on the quiz.

For the teachers that work in more affluent areas, they felt as though their students were driven to learn for the purpose of getting good grades. At this point in the conversation Laurie was trying to explain that PBL would be able to help motivate her students, but if for nothing else, PBL provides a context for learning. Laurie, Stacey, and Chloe are assuming that no one would be able to understand them because they have not experienced their situations. As it turns out both kinds of teachers can work together on creating lessons for PBL. The conversation ends when Stacey shared her thoughts about implementing PBL with her unmotivated students:

> The feedback [on PBL that] I have gotten from here you can definitely apply to somewhere where it is a tougher school, because even giving students that motivation and that encouragement to solve these problems and just doing something that is purposeful and something where it is getting them to really think. I think it is the greatest feeling when you have that success. Right now I am doing a photosynthesis and cellular respiration PBL and the things my students are coming up with I am like this is not where I was expecting you to take it but it's awesome. Even in that sense when you have your

> group of resistance it makes it all the more worthwhile having that end point and I think everyone can speak to that no matter what district you are in.

A closer look at Stacey's comment reveals two important points. First, it shows that the teachers realized they could be helpful to each other regardless of the socioeconomic status of their school districts. Second, as a result of getting the support they needed to implement PBL they realized the value in having teachers from different school districts work together.

Need for Support

While this study focused on the participation in a state-wide community of practice, many of the teachers also spoke about their experiences with collaboration in their own schools and districts. In other words, how participants feel when working with their colleagues and what is being accomplished during the times that they collaborate. This includes teachers' comments about pedagogical differences amongst their colleagues, collaboration with their colleagues, and their perspectives on previous collaborative professional development. In all, the teachers expressed a mixture of dissatisfaction with the level of collaboration in their schools, and a desire to have more fulfilling and supportive partnerships with colleagues who understood their perspective.

Pedagogical differences amongst colleagues. Differences in pedagogical approaches to teaching science were reported as a barrier for the teachers that hindered their collaboration with their colleagues in their schools. During his interview on May 12, 2015, Evan, an experienced teacher, talks about his struggles working in a district with three high schools in which "there is definitely a small percentage of teachers who really want to do these innovative things and people [that have] different strategies [for teaching]." He continues by discussing his struggles with finding colleagues that share a similar pedagogical approach:

> With project based learning there is only a few people that I have seen in my department of 50 something science teachers that really actually want to do things differently then they have. I could be wrong because I don't talk to everybody but from my experiences with colleagues in the department I am seeing a select few that really drive change and I don't think it is really enough to actually get things done and get things changed in our department. So I think this is good to get the help on the side.

According to what Evan is saying, his colleagues have a way of teaching and they do not seem open to changing. Evan believes that there is a need for these teachers to go beyond their departments and schools to seek out the help of others who want to change their practices.

Similarly, Tammy also discussed fighting an uphill battle with her colleagues. During the fourth meeting on April 22, 2015 when we were using a protocol to read an article about the seven essentials of PBL she said, "it makes me reflect on how frustrated I get when I have teachers that I teach the same material, take my PBL that I've made and almost traditionalize it over again." As a novice teacher, Tammy tried to bring a PBL approach to her more experienced colleagues and in a side conversation with me later that meeting she said that her colleagues used her ideas "as projects in a teacher-centered classroom." These recurring examples demonstrate that even when teachers have colleagues with whom they can collaborate it does not mean they have the same approaches to teaching. This data suggests that teachers who are trying to implement PBL face the challenge of working with colleagues who do not share this desire.

Paying it forward. In some cases, especially for the less experienced participants, the lack of support was a result of their colleagues not knowing how to support them because they are not familiar with PBL. The two student teachers, Helen and Stacey shared similar stories that their cooperating teachers were not able to help them with implementing PBL. During the focus

group on April 30, 2015 Stacey said, "I think for my cooperating teacher he is definitely open to some of these ideas but the differences between him and the people we have in our community of practice, they have gone out and really tried to do these things and put these things into practice. So they know the pitfalls and how to come up from those pitfalls and how these things play out." Stacey's cooperating teachers was interested in trying this approach, but since he had no experience with PBL he was not able to offer the kind of support she was able to get from the COP. Stacey continued by saying:

> With my cooperating teacher I think he is at a very similar stage to me in that this isn't something he has done before so it is kind of hard for him to judge where it could go and give me the mentoring I need to play this out. So this has been a big part of my student teaching experience in helping me do PBL and play out these different units, knowing what to expect and knowing how to do all that.

As a result of participating in the COP, the student teachers were able to bring back knowledge of PBL implementation to their cooperating teachers. In a role reversal the student teacher is able to help their cooperating teachers navigate the implementation of a new teaching method.

Collaboration for wrong reasons. Participants spoke about opportunities for collaboration during their districts' faculty and department meetings. All of the teachers reported having time to meet with colleagues but that most of the time was spent on administrative agendas and not on student learning strategies. James's comment during the focus group on April 20, 2015 highlights what the teachers said about their meetings:

> We have science department meetings but people check out as soon as they can. What time we do have to actually work on things together a lot of veteran teachers that are

> trying to get out as soon as they can and don't want to be bothered and it winds up becoming a sharing stuff we already have which we know isn't good.

It seems like collaboration in the teachers' departments are seen as a venue to deliver information and something they are contractually obligated to attend. Later in the conversation James added:

> Like I was saying before everyone wants to get out of the meetings and we don't produce anything. It is just what does my supervisor need me to do at this meeting. It has mostly been this year focused on SGO stuff and paperwork. Less instructional stuff and just administrative paperwork.

Similar to James's feelings about the collaboration in his district, Evan reported feeling frustrated in what is done during the time he spends with his colleagues:

> It is really something that has to get done that the state mandates or the district mandates. Like for example, the Flinn safety certifications and also the chemical safety. Mostly stuff we just have to do and then if it is not one of those mandated things then it is just adjusting the quarterlies or coming up with some kind of review guide or study guide for a midterm. Nothing too productive day-to-day, it is just collaborating on joint assessments on joint assessments that we have to give. It is really not anything that is useful day-to-day (Interview, May 12, 2015).

Teachers do not have positive feelings about collaboration within their schools or departments. They seem to believe that their colleagues do not want to participant in collaboration and this may be due to the perception that the time for collaboration is spent on agendas and announcements. In addition, it seems like the teachers' colleagues share lessons for the sake of sharing lessons, instead of working on best practices.

In summary, the teachers appeared dissatisfied with collaboration in their home districts because they have different pedagogical approaches than those of their colleagues and most have colleagues that lack knowledge of PBL. The teachers also felt that the time they did have to work with their colleagues it was mostly spent sharing resources and working on administrative directives and not working together towards common goals. The teachers' feelings of collaboration in their districts set the stage for trying a different kind of COP.

CHAPTER 5: DISCUSSION AND IMPLICATIONS

The Community of Practice (COP) intervention involved experienced and novice teachers from multiple schools working together. For two hours after school, over the course of four months, eleven science teachers from different schools met in my classroom at a middle school in Central New Jersey to create this ongoing statewide community of practice. Lave and Wenger (1998) identify the common characteristics of effective COPs as a focus on a common concern or set of problems, sharing best practices, a collaborative culture, and creating new knowledge. Using these characteristics as a starting point, participants worked to create and share ideas on using PBL in their classrooms. I simultaneously created an action research project to study the intervention. The aim of this qualitative case study was to understand the experience of the COP from the vantage point of the participants, including myself. The research addressed two questions:

1. What takes place in the community of practice focused on developing problem-based learning?
2. What are participants' perceptions of the value of the statewide community of practice?

Data collection took place over a five-month period. Participants completed four feedback forms: one before the first meeting and another after meetings one through three. After the last meeting, I conducted a focus group with eight participants and phone interviews with the other three teachers who were not able to attend. In addition, I tried to capture audio and video recordings of each of the four meetings. In order to reflect on my perceptions of the meeting, a member of my dissertation group interviewed me five times: once before the first meeting and then after each subsequent meeting. Lastly, I collected documents of the work we created and kept a research

journal where I recorded my own observations, reflections, and further interactions with the participants. After reading the data multiple times, coding, and identifying patterns and themes, interpretations were made. Findings were written by theme to highlight the collective experience of the COP participants.

The major findings of this study fall under three major themes. One theme includes the importance and particularities of my leadership in structuring and facilitating the meetings to meet the teachers' needs. As a full participant during the meetings, my leadership was also important, as I was able to bring my experiences of implementing PBL to help the other teachers. The second theme represents the types of contributions made by all participants. As individuals, the teachers contributed by offering examples of PBLs from their own practice and resources from their own experiences, and by asking questions. This created a resource-rich environment. The teachers worked collaboratively to create PBLs and as full and active participants they made decisions collectively as a group. The overall findings of this study also support that from the teachers' perspectives, a statewide community of practice does promote and sustain ongoing professional growth. Teachers found a place where they could work with others who shared a similar perspective on teaching and learning, and could be driven by each other. Their comments suggest they benefited from working with teachers from across the state, regardless of the school district. Lastly, I found that there is a need for the COP because collaborative practices aimed at helping teachers implement PBL do not exist within their districts.

In this chapter, I will discuss the findings in light of my research questions and literature review. This chapter also discusses the limitations of my study, suggestions for future research, and outlines the implications of the findings for educators who want to develop effective COPs as a form of professional development. I will also share the ways this COP has continued since

the conclusion of the study. The chapter will end with my recommendations for policy makers and a conclusion.

A New Type of COP

There is overwhelming evidence that ongoing professional development is more effective than one-shot workshops from outside experts (Cochran-Smith & Lytle, 1999; Putnam & Borko, 2001; Wilson & Berne, 1999). Teacher learning should be grounded in day-to-day teaching and should be designed to enhance instructional practices, which is why professional development is moving towards collaborative practices such as communities of practice. In fact, the research that has been produced in the last twelve years shows that teachers are increasingly participating in communities of practice as their form of professional development as opposed to bringing in outside experts (Fazio, 2009; Jimenez-Silva & Olson, 2012; Klein, 2008; Morrell, 2003; Nishino, 2012; Woodgate-Jones, 2012). Most of these communities of practice take place within the teachers' schools or districts.

Research also shows that COPs work best when they are supported by educational leaders and teacher leaders. Studies done by Borg (2012), Printy (2008), and Bourhis, Dubé and Jacob (2005) show that external leadership from principals and department chairs is influential in creating collaborative experiences that result in shared knowledge. In order for leaders to create such experiences they must provide structure and support. Administrators must provide time, moral support and even resources for COPs to work. Additionally, research done by Baker-Eveleth, Chung, Eveleth and O'Neill (2011), Borg (2012), and Thornton and Cherrington (2014) uncovered the importance of distributed leadership provided by the teachers within COPs. During COP meetings, teachers embraced leadership roles by making decisions, offering expertise, and contributing towards developing a shared repertoire. Educational leaders and

teacher leaders play distinct but separate roles within communities of practice. There is no research on teachers taking on the responsibilities of the educational leaders.

My research also confirms the importance of leadership, but as both the creator and participant in the COP I did not fit neatly into either of the leadership roles. While I took on the role of administrator by taking responsibility for the existence of the COP; more specifically, arranging for the time and space for the meetings, snacks, moral support, and resources. I was also a teacher/participant bringing knowledge from my own practice to the meetings. For example, I put together a PBL "package" for the teachers that I had created for my high school biology students, on the topic of evolution. As part of this package, I included all of the documents that I created including the presentation of the problem and the daily lessons. It also included rubrics for the students and the authentic audience, timelines, and checklists. In a subsequent meeting, we went through the documents and discussed a PBL unit from start to finish. I was able to meet the teachers' needs by bringing examples from my own practice. This type of teacher leadership, starting and sustaining a statewide community of practice outside of the constraints of school, had not yet been studied.

Another important finding that confirms what is known about successful communities of practice is the importance of having participants who are willing to learn. The teachers in my research study may have been willing to participate because they were my colleagues, knew of my classroom practices, or were interested in learning something new. Regardless of the reasons, having willing and voluntary participants was a key factor in making the collaboration work. The research supporting communities of practice reveals that successful communities of practice include people who may not work together every day, but meet because they find meaning in the collaboration (Mittendorff et al, 2006; Wenger et al, 2002). In our case, the combined efforts of

the group resulted in the creation of new PBLs. An example of this occurred during the fourth meeting on April 22, 2015:

> Kristina: What is the problem with the fear of GMOs?
>
> Laurie: I don't know. It's weird, but I think people don't understand what actually constitutes a genetically modified organism. Intentional selective breeding is technically a GMO. The strawberries I buy at Wegman's are GMOs because it is like, take the best of the best, mix them together, versus I'm splicing out DNA from this one thing and putting it in another thing.
>
> Kristina: People aren't even familiar with selective breeding.
>
> Laurie: Maybe it's more like awareness. You want to throw around, 'I'm so ecofriendly, I'm so healthy because I don't eat GMOs.' Do you even know what that means?
>
> Kristina: I think that's part of the issue is that when we talk about why European countries...these people are protesting like crazy in European countries, 'No GMOs. Stop GMOs,' everyone is hating on Monsanto and there is like this whole, especially in the EU, it's a big deal, and a part of the problem is that people aren't educated to know what they are and what they can do.
>
> Rich: Why [do] some GMOs have a negative component to them, that's the problem, there is a misunderstanding. One paintbrush is being used to paint all GMO.
>
> Kristina: How do you educate people?
>
> Rich: Authentic audience everybody.

This form of collaboration contributes to building teachers' capacities to implement PBL. In the cases of Klein's (2008) and Morrell's (2003) pre-existing communities of practice of three and five teachers respectively, teachers were able to build their capacities because they had a built in

community with shared leadership and used authentic dialogue to connect professional experiences to their practice. In my COP, the teachers volunteered to participate, which means they were willing to participate from the start and this resulted in a collaborative environment. In my study, as well as Klein's (2008) and Morrell's (2003), the teachers were able to work together to solve problems. Overall, this example shows that the collaborative efforts of teachers willing to participate results in a richer experience.

Teachers' Voice and Choice

Although it is known that having strong leadership and willing participants result in productive communities of practice, it does not mean that this is what is being implemented around the country. According to studies done by Graham (2007) and Hipp, Huffman, Panake and Oliver (2008), mandated professional learning communities, with involuntary participation, that were embedded in common planning time during the school day, did not result in productive learning. They found that this was due to a lack of shared vision. The teachers in my study reported similar perspectives about the collaboration in their own schools. Common pitfalls of communities of learners often relate back to a lack of a clear vision even amongst participants (Dana & Yendol-Hoppey, 2008; Putnam & Borko, 2000). Participants of this study discussed the lack of productivity. James shared:

> Like I was saying before, everyone wants to get out of the meetings and we don't produce anything. It is just 'what does my supervisor need me to do at this meeting?' It has mostly been this year focused on SGO stuff and paperwork. Less instructional stuff and just administrative paperwork (Focus group, April 20, 2015).

Forcing collaboration does not always lead to professional growth and knowledge building. Deeper success is experienced when teachers are provided guidance during their own learning

process. Yet, learning communities appear to be becoming the panacea to every problem that teachers are experiencing.

One alternative to the traditional school-based learning communities is the statewide community of practice that I created, which differs from the majority of communities of practice in a number of ways. The teachers in my study participated voluntarily after school, which means it was not mandated and does not take place during common planning time. We organized our own learning environment where the teachers wanted to learn and were not being weighed down by reluctant participants. As it turns out the teachers in my study were very appreciative of having a space that was not like the learning communities in their own schools. The teachers discussed their feelings during the focus group on April 30, 2015:

> James: I think especially when you are in a district where you may be the one who is the most forward thinking you kind of don't have the support or someone to measure up against. Like you said [Jeanne] setting the bar higher. What's the Biological Principle? Is it the Red Queen Hypothesis? When one species drives the other to become more and more. I feel like that is what is going on here.
>
> Chloe: An extended learning community that works together to create authentic problems that can be used in our classrooms.
>
> James: To share skills. You [Cassandra] are really skilled at authentic problems and that pretty much blows me out of the water. Every time you talk about another thing you did I am like 'Oh my word.' I think you raised the bar for me.

The teachers found meaning in the collaborative practices of the COP because they were with like-minded colleagues who supported and pushed each other. Communities of practice that take place outside of school serve as an untapped opportunity for professional development.

Going Beyond Apprenticeship

Lave and Wenger (1991) propose that novice participants in a community of practice only engage in low-risk activities since they are not as highly qualified and/or not considered masters of knowledge or practice. They argue that "social relations of apprentices within a community change through their direct involvement in activities; in the process, the apprentices' understanding and knowledgeable skills develop" (p. 94). In contrast to this idea of novice teachers being apprentices, the other compelling finding from my study is that it is, in fact, possible to create the conditions where novice teachers are full and active participants in the work. In this type of collaborative environment, the novice teachers did not have to worry about being evaluated or compared to their peers. Novice teachers joined the conversations from the beginning to help create knowledge and share their repertoire of resources. For example, let us examine the exchange between Laurie and Tammy, two novice teachers, during the last meeting.

> Tammy: All this week we've been talking about dirty sources of power so we're going to segue into talking a little bit about Hurricane Sandy. I have some pictures of charging stations that people set up, and there is actually this one charging station that a guy was powering with an exercise bike, so I am pretty excited about that.
>
> Laurie: There is a company called Uncharted Play, Have you ever heard of it? The item is a super expensive prototype but it is about how do we get kids in Uganda that have iPhones but don't have electricity. The first introductory product was called the Soccket Ball, and it is a soccer ball that has a motor in it that as you kick it around and it is turning, it is actually creating electrical charge so then the kids can plug their iPhone into it and it works. (Fourth meeting, April 22, 2015)

In this case, the novice teachers were taking responsibility for their own learning and jumped right into participating. Novice teachers did not start on the periphery but rather were part of the core from the beginning. If someone walked into this statewide community of practice they would find it difficult to identify novice from experienced teachers. Here novice teachers can be full-fledged members from day one.

Research Limitations

The overall design of this qualitative study included certain limitations. One limitation may have been my knowledge and work with some of the teachers in the community of practice. Over the past year, I have not only been working with some of the members of the community of practice, but I have also provided professional development for educators with a focus on problem-based learning. This level of previous involvement and knowledge of communities of practice and problem-based learning could have ultimately skewed the interpretation of the data because of my biases and beliefs. Similarly, as the leader of the group and of the study, the participants may have said things that I wanted to hear and were not completely honest. Several actions described in Chapter 3 including member checking to determine the accuracy of the data and the triangulation of data across multiple sources, were taken to address this potential limitation.

Also, due to the way in which the group operated, I was not able to record all of the activity, which meant I did not have transcripts of everything that happened. I did not take into account that we were going to break out into smaller groups and spread out around the room. The one audio and video recorder that I had set up was not enough to collect the data from multiple group interactions. The method of data collection was not sufficient for the ultimate group interaction. Had I of had the foresight to be prepared to record all of the conversations from the

group interactions, I am confident that this data would have only enhanced the research study; however, to the extent of which I cannot speculate.

Cautions should also be used when making generalizations about the participants' use and implementation of PBL. I did not observe their classrooms and although some teachers shared examples from their practice, I have no data to support the extent to which it is being implemented.

The small case study design of this research limits the overall application of the results to other settings (Merriam, 2009); however, findings from this study provide an in-depth understanding for those who are seeking to further develop communities of practice as a professional development tool. The findings provide insight about the structure of a statewide COP and insight from the teachers' perspectives, which are powerful tools when trying to gain support during the implementation phase.

Research Implications

The findings of this study indicate multiple opportunities for other possible research studies in regards to communities of practice and professional development for teachers. More studies investigating the structure of communities of practice conducted with different teachers implementing PBL would strengthen the validity and reliability of this study.

Throughout the study, I found that my role as the leader was important to the success of the community of practice. Participants also mentioned that leadership was important in keeping the group focused and tailoring the meetings to their needs. Currently, there is little significant research that describes teachers as founders and leaders of communities of practice. Further, studies, which investigate the role of the teacher leader in the implementation, sustainment, and the correlation with the success of professional development as it corresponds to communities of

practice, could provide additional insights for educational leaders. Investigating leaders' perceptions of communities of practice could provide meaningful insight for other leaders aspiring to implement the framework for a community of practice.

While the teachers involved in this study discussed the impact the community of practice had on their confidence with implementing PBL it creates another opportunity for further research to determine the extent to which the teachers implement PBL as a result of their participation in a community of practice. There is limited research that provides specific data from longitudinal studies that look at PBL implementation as a result of professional development.

Implications for Practice

Since the completion of the research study, the group, at its own request, continues to meet monthly, even through the summer and has continued to develop PBL lessons. In addition, I approached the Biology Teachers Association of New Jersey (BTANJ) with my research because the organization is a registered professional development provider for the NJ Department of Education. The BTANJ has agreed to support the statewide COP as a form of professional development (PD) offered to its members. Considering our learning community currently has twelve members and the BTANJ current membership is comprised of over 350 members, growth of our learning community seems inevitable. The prospect of growing our COP not only brings the excitement of sharing and spreading our pedagogy, but also concerns regarding the challenges we will undoubtedly face in introducing new personalities into an already established group.

One such concern discussed by the participants is that the addition of new members could reduce the productivity of the group; for example, the possibility of spending the majority of the

time convincing new members on the merits of PBL as opposed to its further implementation and adaption. To address these concerns, with their feedback, I made an introductory video, which potential members must watch before attending their first meeting. This will give new members an opportunity to understand who we are and what we do. In addition, it provides information about PBL. During their first meeting, any potential new members spend the time shadowing a current member. They do not participate; only observe. Our plan is to debrief with any potential members after their introductory session to see if they are a good fit for our community.

While this study reinforces my belief that all teachers should be highly encouraged to participate in learning communities, I believe it should be up to the teachers to decide which communities they decide to join and this statewide community of practice should be one of those options. Perhaps this does not mean ending school-based learning communities because there may be teachers who would not choose to participate in a group that meets after school hours or they need particular support or skills that their supervisors can provide for them. This study shows that collaborative learning communities do not have to take place in school. In fact, if school administrators are going to mandate working in collaborative groups, teachers should be able to pick the people they want to work with who are interested in learning the same things.

Findings should also be reviewed by educators interested in creating COPs as a means to support the implementation of new curriculum in other subject areas. To implement a statewide community of practice, I would recommend starting with a few willing participants who share the same vision. When I asked the teachers about the kinds of support they would need to help foster COPs at their schools, they discussed needing to be around like-minded colleagues and to have support from their supervisors. Beth said, “Someone to lead the COP that knows a lot about

the topic at hand and who is really good at providing structure to the meetings" (Fourth feedback form, March 28, 2015). To this end, I would also suggest training teachers on how to run a community of practice. This would include understanding their roles as leaders to foster a collaborative environment to create new knowledge. Although this study focused on a small group of teachers in New Jersey, I hope that our work as a statewide community of practice will yield a starting point and inspire other educators around the state to create COPs.

Implication for Policy

Communities of practice go a step beyond professional development by providing teachers with not just skills and knowledge to improve their teaching practices, but also an ongoing community that values teachers' experiences and uses those experiences to guide teaching practices. The message from policy makers in the State of New Jersey is that "professional development should include the work of established collaborative teams of teachers...who commit to working together to accomplish common goals and who are engaging in a continuous cycle of professional improvement" (N.J.A.C. 6A:9-15.2). Policy makers recognize the importance of learning communities to sustain teacher growth. I recommend that a statewide community of practice be supported by the state as a means of professional development.

According to the New Jersey Department of Education, New Jersey schools, grades 6-12, must begin implementing the Next Generation Science Standards by the start of the 2016-2017 school year (Michael Heinz, State Department of Education, personal communication April 22, 2015). Policy makers need effective ways to increase teachers' capacities to implement NGSS by providing professional development opportunities that support pedagogical approaches that align with NGSS. The statewide community of practice could serve as a platform to help teachers

make the shift in their teaching practices. Policy makers should consider funding the development of teacher leaders so that they have the capacity to develop more communities around the state. Statewide communities of practice should play a role in not just preparing teachers to adopt the standards, but adapt to them.

Conclusion

This research provides insight into the structure and perceptions of a statewide community of practice designed to support teachers' implementation of problem-based learning. The catalyst for my decision to conduct this research was borne from my own experiences working with teachers from around the state to create and implement problem-based learning pedagogy as a way to put NGSS into practice. My work in developing a statewide community of practice was timely because of the limited availability of willing teachers to collaborate within our own schools.

Based on the findings of this study, my leadership, the teachers' contributions and our collaborative work were important to the structure of the COP. In addition, the teachers perceive the community of practice as unlike any professional development experience they have had and unlike the learning communities in their own schools. I created an environment in which not only experienced teachers contributed to knowledge creation, but where novice teachers were full participants from the start.

Schools should allow teachers to self-organize so that they can develop their own collaborative groups with teachers who share the same interests. As a result of my study, it is my hope that local administrators as well as policy makers in New Jersey will recognize and support the implementation of more COPs across the state. It is imperative that teachers' professional growth be supported outside the structure of the school environment. Communities of practice

provide the framework and foundation for promoting growth of teachers and their implementation of the Next Generation Science Standards.

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Appendix A

First Feedback Form

1. How many years have you been teaching?
   A. This is my first year teaching
   B. 1-3 years
   C. 4-10 years
   D. 10+ years
   E. I am currently student teaching
2. What current grade level(s) are you teaching? If you are not currently teaching what is your current role in education?
3. What type of science are you currently teaching?
4. Where do you teach/work?
   A. Warren, Sussex, Passaic, Bergen, Morris, Essex, Hudson or Union County
   B. Hunterdon, Somerset, Middlesex, Mercer or Monmouth County
   C. Burlington, Ocean, Camden, Atlantic, Gloucester, Salem, Cumberland, or Cape May County
5. What is your current level of experience creating problem-based learning lessons? (1- what is PBL to 5- I can help others)
6. What is your current level of experience implementing problem-based learning lessons? (1- none to 5 -I use it all of the time)
7. How often do you use PBL in your classroom?
8. In what ways are you using PBL in your classroom?
9. If you use PBL what are your biggest challenges?
10. Why are you interested in developing/using PBL?
11. How often do you collaborate with your colleagues? (1- never to 5- almost every day)
12. How satisfied are you with the collaboration? (1- not very satisfied to 5- very satisfied)
13. Describe the collaboration.
14. To what extent does collaboration, in general, impact your practice or planning? (1- no impact to 5- I don't know what I would do without it)
15. How much PD/training have you received on PBL?
16. To what degree of satisfaction do you have with the professional development offered by your school? (1- not satisfied to 5- very satisfied)
17. Does your school offer PD/training on PBL? If so please describe.
18. What do you hope to gain from participating in this community of practice?
19. What can the group help you with in terms of PBL implementation? (Lesson planning, pedagogy, etc.)

Appendix B

Second Feedback Form

1. Please enter your name.
2. How would you describe your experiences as a member of the COP?
3. Share an instance that has been most valuable to you.
4. How do you describe your role in the COP? In other words, how do you interact with members? (Active, passive, bringing ideas to the table, etc.)
5. How has the COP thus far, shaped the way you think about collaboration?
6. What new activities or functions (during the meetings) would be of greatest interest to you?
7. How has the community helped you solve problems of practice thus far? (Or shape the way you think about problems of practice within your own classroom)
8. What are the strengths of the community?
9. What are the weaknesses of the community?
10. In what ways has the COP shape the way you think about teaching PBL thus far?
11. How do you think the COP has shaped how you teach PBL thus far?
12. In addition to creating a PBL, what would you like to work on during the next meeting?

Appendix C

Third Feedback Form

1. Please enter your name.
2. How would you describe your experiences in the second meeting?
3. How do you feel about the content (what we actually did/accomplish)?
4. Share an instance that was valuable to you.
5. In what ways did you interact with the other members of the group?
6. In what ways is your role in the group evolving or not evolving?
7. What are some examples of ideas from the meetings that you have been able to apply to your classroom/job?
8. What are some improvements that can be made to the meetings or the collaborative group?
9. Would you prefer to have more or less say as to what is happening during the meetings?
10. What would you like to work on during the next meeting?

Appendix D

Fourth Feedback Form

1. Name
2. How would you describe your experiences in the third meeting?
3. Share an instance that was valuable to you.
4. What are some examples of ideas, lessons, resources, etc. from the meetings that you have been able to apply to your classroom/job?
5. How would you describe the collaboration taking place during the meeting?
6. How is this collaboration different or the same from the collaboration you experience with your colleagues?
7. What types of supports need to be in place to help foster COPs at your school?
8. Moving forward (after April), what would you like to see happen with our COP?
9. What would you like to work on during the next meeting? (What are some things that the group can help you with to help transition to using PBL in your classroom?)

Appendix E

Focus Group Questions

"Thank you for agreeing to participate in this focus group. We are meeting today because you have participated in a community of practice focusing on creating PBL's for science teachers. Before we begin I wanted to set some guidelines for the discussion. First, there are no right or wrong answers to the questions. Please feel free to be honest with your responses. Second, the discussion will be audio recorded so please try to have one person speak at a time. Lastly, my role as moderator is to guide the discussion. I will not be a participant any further than moving the discussion along."

1. What does the COP look like now?
    - How has it changed?
    - What do you think accounts for the change?
2. Now that you have participated in a state-wide community of practice, how would you describe this group to someone who is unfamiliar?
    - What are some of the key characteristics?
3. Describe the interactions you have had with each other.
    - How does having members of varying experience levels shape the COP meetings?
4. How is this collaboration different from that of what you experience at your school/with your colleagues?
    - How does the collaboration help or hinder your work towards PBL?
5. How does the COP meeting compare to your previous PD experiences in terms of learning?
    - Share an example
6. To what extent could you plan for or create a PBL by yourself as a result of these meetings?
7. There were some resources that were brought up over and over again during the meetings and in the feedback forms as being beneficial and useful; can you speak to some of the examples of the resources you're using in your classroom as a result of the meetings?
8. What are some barriers that are still preventing you from using PBL in your classrooms?
9. In what ways does a busy schedule make it challenging to participate in a community of practice?

Appendix F

First Reflective Interview Questions

1. How were you introduced to PBL?
2. When did you start using PBL?
3. What changes in your students learning did you see when you began using PBL?
4. What do you think are the overall benefits of using PBL to students?
5. How did you start noticing the benefits of collaborating to plan PBL in your classroom?
6. How did your instruction change once you started collaborating to plan for PBL?
7. What gave you the idea of creating a statewide COP?
    a. Why teachers from other schools?
8. What have you seen so far as the benefits for teachers participating in the COP? In terms of PBL and collaborating.
9. What have you seen so far as the struggles for teachers participating in the COP? In terms of PBL and collaborating.

Appendix G

Second Reflective Interview Questions

1. How do you think the first meeting went?
2. What happened during the meeting?
3. Describe the participants (active or passive)?
4. How would you describe your experiences as a member of the COP?
5. Share an instance that has been most valuable to you.
6. How do you describe your role in the COP? In other words, how do you interact with members?
7. What are the strengths of the community?
8. What are the weaknesses of the community?

Appendix H

Third Reflective Interview Questions

1. How do you think the second meeting went?
2. What did you accomplish?
3. Did you notice if any of the participants' roles started to evolve?
4. How would you describe your experiences as a member of the COP?
5. How is your role evolving if at all?
6. Share an instance that has been most valuable to you.
7. What are some improvements that can be made to the community?
8. What do you think is working?

Appendix I

Fourth Reflective Interview Questions

1. How would you describe your experience in the third meeting?
    a. How did it go being a facilitator versus an active participant?
    b. What about with the small breakout groups?
    c. What did you accomplish?
2. How would you describe the collaboration that took place?
3. Did you notice if any of the participants' roles started to evolve?
4. Share an instance that has been most valuable to you.

Appendix J

Fifth Reflective Interview Questions

1. How would you describe your experience in the last meeting?
    a. Did you facilitate or participate?
    b. What did you accomplish?
2. How would you describe the collaboration that took place?
3. How would you describe everyone's roles after four meetings?
4. What do you think are the strengths of the COP? Weaknesses?
5. Moving forward, what do you hope to see happen to the group?