

University of Alberta

Lesson Study: Mathematics Teachers become the
Professionals in their Professional Development

by

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Dedication

To Craig, Zachary, Ethan, and Natalie

Abstract

This research begins with an argument for the implementation of a professional development model that would empower mathematics teachers to make changes to their mathematical teaching practices. As this argument evolves so does the need for further investigation into what key components are necessary for effective professional development. What emerges from this investigation is the discovery of a Japanese professional development model known as Lesson Study.

This research includes a case study that allows for an exploration of mathematics teachers as they, using the Japanese Lesson Study process, collaboratively research, implement, and reflected upon how this alternative professional development model influences changes in their mathematical teaching practices. The three mathematics teachers in this case study provide evidence and support for how Lesson Study can be used as an effective professional development model while providing the opportunity for teachers to be the professionals in their professional development.

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CHAPTER ONE - INTRODUCTION

Mathematics Teachers in need of Professional Development

In Japanese lessons, there is the mathematics on one hand, and the students on the other. The students engage with the mathematics, and the teacher mediates the relationship between the two. In Germany, there is mathematics as well, but the teacher owns the mathematics and parcels it out to students as she sees fit, giving facts and explanations at just the right time. In U.S. lessons, there are the students and there is the teacher. I have troubles finding the mathematics; I just see interactions between students and teachers. (Stigler and Hiebert, 1999, p. 26)

In addition to two days designated for “teachers’ convention” there are, within my school district’s yearly calendar, two non instructional days designated for teacher professional development. The professional development committee often chaired by the principal, uses district priorities, superintendent direction, and the mandated school wide instructional focus to determine and prepare the topics, presenters, and agendas for each professional development day. In most cases the presenters are often fee for service consultants who are brought in from outside of the school. With the exception of making lunch plans and choosing the calendar dates for professional development, teacher input is not part of the planning process. In the fifteen years I have been teaching with my school board there are only four days, of the possible 200 that constitutes a school year, set aside for professional development, the sacred time staff has to learn together is being hijacked by administrative agendas.

Over the past five years the instructional focus, which for my school was “reading for understanding”, has dominated professional development opportunities. Professional development decisions are no longer made in the interests of individual teachers and the specific concerns in their classrooms. Principals are expected to evaluate their financial decisions regarding professional development opportunities for teachers directly to the school’s instructional focus. This has resulted in two outcomes. The first, teachers were learning how to creatively manipulate their professional development proposals requesting monies to attend specialist conferences in subject areas other than the one specific to the instructional focus. Second, and perhaps the most disappointing, was that eventually many teachers in the non focus subject areas stopped making professional development requests. It didn’t take long for teachers to start commenting that they would rather remain in their classes than attend a professional development workshop where they felt the topics presented were irrelevant to their teaching assignments. The professional development opportunities available for teachers were not generating the type of teacher responses for which they were intended.

What factors make up effective Professional Development?

As a result I have found myself asking numerous questions about the purpose of professional development and what I, as an educational leader, could do to provide teachers with more meaningful opportunities. The implementation of the instructional focus in my school district has changed teachers’ assumptions and philosophy regarding professional development within schools. With

teacher concerns no longer the priority, I was perplexed as to who is the professional in professional development? I have always believed that professional development is most effective when it addresses the concerns and uniqueness of teachers and students in a specific context. It baffled me that the decisions regarding the approval of professional development opportunities for teachers were being made by someone in an administrative position rather than by teachers. Perhaps the one question, although really more a statement than inquiry, is how could a district wide administrative professional development agenda expect to impact the professional growth of teachers as they strive to improve their teaching practices within their classrooms?

Mewborn (2003) states that teachers should not be expected to modify their teaching practices just because someone of authority tells them they should. For a teacher to do so would only result in a superficial short term change in practices. For professional development to be of value to teachers, it needs to make direct connections to the teaching and learning in their classrooms. According to Deborah Ball (1997), teachers are more likely to make changes to their teaching practices when they are empowered to determine the focus of the changes they believe are necessary. Mewborn proposes that teachers need professional development opportunities that they can try in their classrooms, thus making the classroom a "learning laboratory" (Cobb, Wood, & Yackel, 1990, p131). Using these three elements; connecting professional development to the teaching in classrooms, empowering teachers to determine the focus for change, and teachers using their classrooms as laboratories I am beginning to develop a foundation

for the professional development opportunities I want to offer to teachers.

In many aspects, the professional development opportunities I am searching for resembles action research. Action research is a cyclical process that allows teachers the opportunity to use “professional (informed) eyes to observe their own practice” (Arhar and Kasten, 2001, p.15). Teachers study their own teaching practices, explore alternative practices either through literature or collaboration with colleagues, develop a plan of action, implement the plan in their classroom, and reflect upon the outcome. Through this reflective and collaborative form of practice, action research provides teachers with experiences to help them develop a deeper understanding of their own practices and to critically implement changes in their teaching (Ball, 2000). Supporting professional development opportunities that allow teachers to be researchers in their classrooms, Schifter and Fosnot (1993) and Ball identify the importance of teacher collaboration as a means of transforming the traditional isolative work of teachers. The professional development opportunity I am planning to implement will allow for teacher collaboration, connections to the teaching in classrooms, classrooms as teaching laboratories, and the empowerment of teachers in determining the focus for change.

Lesson Study as a model for Professional Development

I was first attracted to Lesson Study, the Japanese professional development practice, while reading James Stigler and James Hiebert's book *The Teaching Gap: Best Ideas from the World's Teachers for Improving Education in the Classroom*, written in 1999. Lesson Study, a cyclical process, is a teacher led,

collaborative process that focuses on student learning within the specific classrooms of the teachers in the Lesson Study group. Throughout the Lesson Study process, teachers gain a deeper understanding of how their teaching practices impact student understanding.

After extensively reading about how Japanese and American teachers have successfully incorporated Lesson Study into their professional development plans, I wanted to understand how the Lesson Study process could best be implemented into local classrooms and achieve similar results. Up until very recently the majority of the literature on the adaptation of Lesson Study in North American mathematics classrooms has been from the United States. In Canada, the Lesson Study process is just beginning to build momentum. Although there may be others, the current Canadian Lesson Study literature (Harrison, 2004) only makes mention of the York Region District School Board in Ontario as having implemented a district wide Lesson Study project. More research is needed to help identify how a Japanese professional development practice for teachers can best be adapted to meet the needs of mathematics teachers in Alberta. To help gain insight into a descriptive case study has been developed.

Research Questions

I have chosen to use a descriptive case study as my research method due to its ability to provide a “detailed account of a phenomenon under study” (Merriam, 1988). Merriam identifies descriptive case study as an effective research tool when investigating, without prejudice, an area in education where there is little written research. Knowing that there is little research

surrounding the use of Lesson Study in Alberta I plan to use the recorded professional teacher conversations, reflections and observations gathered throughout this descriptive case study to provide an understanding of how the Japanese Lesson Study process can be used to provide effective professional development to teachers in Alberta. By implementing the Lesson Study process within an elementary school in Edmonton Alberta, this research will address if the Lesson Study process, implemented in a Canadian school, is an effective professional development opportunity for mathematics teachers as they work to improve their teaching practices. Questions for exploration throughout this case study include:

Research Question #1: Is Lesson Study an effective Professional Development Model?

Stigler and Hiebert (1999), claim that, if implemented in North American schools, the Japanese Lesson Study model would provide effective and meaningful professional development for teachers as they adapt their teaching practices in response to their understanding of student learning. By implementing the Lesson Study process with four to five mathematics teachers in an Alberta school, this research will investigate and reflect upon how the attitudes and teaching practices of the teachers were influenced. In essence, does the implementation of Lesson Study live up to the expectations set out in the literature?

Research Question #2: From the perspective of mathematics teachers in Alberta, what are the benefits and drawbacks of the Lesson Study process?

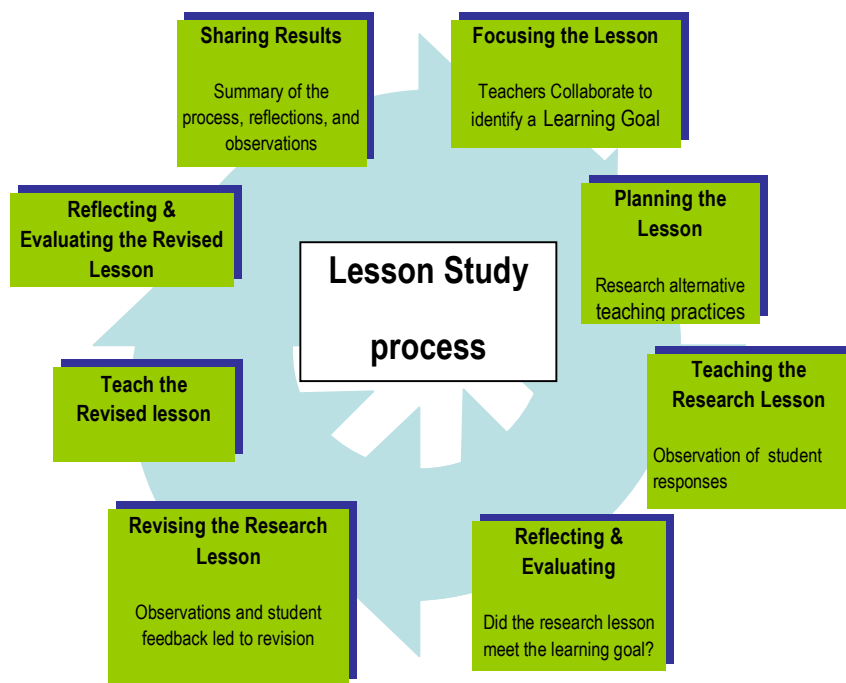
In addition to investigating the influence of Lesson Study on the improvements made to mathematical teaching practices, this research hopes to explore any further impacts that the Lesson Study may have on the teachers involved. According to Stigler and Hiebert (1999), because teaching is cultural, any attempt to make changes to teaching practices needs to be respectful of the cultural norms held by teachers. Two norms that are of particular interest are teacher isolation and time. By being cognizant of time commitments and allowing teacher collaboration over an extended period of time, this research seeks to address these norms and asks the teachers involved to share their input. Ultimately this research is looking for understanding of how the Lesson Study process can be both beneficial to the professional development of teachers and how specific drawbacks could sabotage its success.

CHAPTER 2 – LITERATURE REVIEW

Lesson Study as a Professional Development Model

Rock and Wilson (2005) describe Lesson Study as a traditional Japanese professional development process consisting of eight steps: focusing the lesson, planning the lesson, teaching the lesson, reflecting and evaluating the lesson, revising the lesson, teaching the revised lesson, reflecting and evaluating the revised lesson, and sharing the results. Their process can pictorially be modeled as a cycle (figure 1).

Figure 1. Lesson Study process.



Rock and Wilson (2005) explain how in Japan the Lesson Study process involves three to five teachers working collaboratively, over a four month period, on the creation and

implementation of a research lesson. The Lesson Study begins by focusing on a specific teaching and learning goal. This goal stems from an area or topic that the teachers have identified as problematic for students. Using the Lesson Study goal, the teachers collaboratively research to develop a lesson, known as the research lesson, that they believe will best achieve this goal. One teacher teaches the research lesson while the rest of the Lesson Study group observes, taking notes about student responses to the teaching practices being implemented. After the research lesson is taught the Lesson Study group gathers to share their observations, reflect on the lesson, and provide feedback. Using the information gathered during the feedback session, the research lesson is revised. The revised lesson is taught, by another teacher in the Lesson Study group, to a second class of students, while the Lesson Study group as well as invited school faculty and visitors observe. Following the teaching of the revised lesson all those who observed are invited to the feedback session to share their observations. The final step is the sharing of results. Teachers in Japan will often publish their research notes, observations, meeting summaries, and reflections. These publications are shared amongst schools and are used by the government to generate new curriculum and curriculum resources.

Tad Watanabe (2002), along with a group of educators, went to Japan to observe the Lesson Study process in an attempt to answer his question as to whether the American teaching culture could adopt this Japanese practice. Watanabe describes how, prior to his visit, he had allowed his misconceptions about the work of Japanese teachers to distract him from seriously considering the implementation of Lesson Study in American schools. He had

previously believed that teachers in Japan were successful in their use of Lesson Study because they were subject specialist who spent half of the school day in classes and other half planning with other teachers. Watanabe during his conversations with Mr. Yokota, a grade five /six teacher, realized Japanese elementary teachers, just like American elementary teachers, are generalists who teach all day.

During his visit, Watanabe (2002) was given an opportunity to observe a research lesson being taught to a grade five/six mathematics class. The research lesson was prepared and sequenced within the context of a unit. The teaching teacher was very confident and familiar with the observation process. Members of the observation group were provided with the lesson plan and an observation sheet to record anticipated student's thinking. The lesson plan was written using three columns; task, anticipated student response, and instructional considerations. The observation sheet was very simple. There were two columns, one for teacher activities and other for student responses. Observers were told to circulate about the room observing and recording student work and listening to student comments and questions. Observers were not to teach any of the students, especially those who were struggling (p. 38).

Although Watanabe (2002) was not available to participate in the feedback and research lesson revision sessions, he found the observation session rich with information about student learning. Watanabe commented that to implement Lesson Study in the United States, the culture of schools would have to be more accepting of teacher collaboration. Teachers would have to be

willing to spend time working together rather than continue to work in isolation. Although I acknowledge that the present culture of our schools supports teachers working in isolation, I believe that if provided the opportunity teachers would prefer to work collaboratively.

The Timeline of Lesson Study in North America

Lesson Study, although a common practice in Japan, is just beginning to find its place in the professional development of teachers in the United States. Throughout the literature on Lesson Study, educational researchers: Clea Fernandez, James Stigler, Makoto Yoshida, and Catherine Lewis are credited with introducing and educating American teachers about the impact of Lesson Study as a model for the professional development of teachers. In 1989, Makoto Yoshida, as a doctoral student under the supervision of James Stigler at the University of Chicago, began research into the process of Lesson Study and its connection to the teaching and learning in mathematics education. In 1991, James Stigler along with Makoto Yoshida and Clea Fernandez began the first video study to compare the differences in classroom practices between Japan and the United States. Two years later, at the same time that Makoto Yoshida was beginning to collect data for his doctoral study on Lesson Study in Japan, Catherine Lewis first observed Lesson Study while doing research for a new book in Japan. In 1994, Lesson Study arrived in the United States when Stigler and Fernandez, in consultation with Makoto, formed the first American Lesson Study group at the University of Los Angeles (Chokshi, n.d.). In 1995, based upon their analysis of the data collected from the TIMSS videotape study, Stigler and Hiebert co-authored the book *The*

Teaching Gap (published in 1999). No one could have predicted the rate at which the popularity of Lesson Study would soon grow.

1999 was the year that Lesson Study made its first real debut in North American schools. With Lewis, Fernandez and Yoshida initiating the first school district wide Lesson Study projects in San Mateo, California and Paterson School Number Two in New Jersey and Stigler and Hiebert's book *The Teaching Gap* available on bookshelves, a North American Lesson Study explosion was about to occur. In May of 2000, Paterson School #2 held the first American open house showcasing the benefits of Lesson Study as a professional development opportunity that had been successful in guiding teachers in the improvement of their teaching practices. By 2004, just five years after the publication of Stigler and Hiebert's book, there were at least 125 school districts with over 2300 teachers in 32 states using the Lesson Study model (Chokshi, n.d.).

Implementation of Lesson Study in North America:

Methods, Successes, & Headaches

Due to the callowness nature of Lesson Study in North America, much of the reported literature from schools and school boards consisted primarily of procedural data and offered very little evidence of long term changes in the teaching practices of practitioners. Despite this lack of evidence, there is still a great amount of value in reading and learning from the adaptations American schools have made to the Lesson Study process. To help formulate my own method for the implementation of Lesson study I have chosen to closely examine how five different North American schools have adapted and implemented the Lesson Study process.

Throughout my examination I am seeking not only for insight into how I could most successfully implement the Lesson Study process into my school, but also for any complications that other schools using the Lesson Study process may have encountered.

Many schools, such as North Marion Middle School in Aurora, Oregon, who began the Lesson Study process in 2001, have successfully implemented the Japanese Lesson Study model with little modifications. The Lesson Study group at North Marion, consisted of five grade six teachers who met for 45 minutes after school, twice a week. Teachers spent the first few Lesson Study sessions first determining what qualities they believed made a strong mathematics student and then comparing their students to this criterion. This comparison allowed the teachers to distinguish between where their students were performing at and where the teachers wanted them to be. By analyzing the performance of their students on standardized tests, the Lesson Study group began to narrow their Lesson Study focus to measurement. To narrow their focus even further required lengthy conversation and emotional self reflection regarding how successful various teachers felt they were at teaching particular measurement concepts. Eventually it was decided that students and teachers were both struggling with the mathematical concepts of area and perimeter. Now that the Lesson Study group had established their focus they turned their attention to the research regarding best practices in mathematics education. After experimenting with one or more of these best practices in their classrooms, each group member reported back to the Lesson Study group with what they had experienced (North Marion Middle School Lesson Study Team, n.d).

The next, and most critical, step for the Lesson Study group was planning the research lesson. The Lesson Study group generated numerous drafts before agreeing to implement one final research lesson plan. During the planning phase, the Lesson Study group chose to collaboratively perform selected mathematical tasks in an attempt to anticipate the numerous approaches their students might use. Research done by Shifter (as cited by Mewborn, 2003) and Cooney (1988) found that when teachers discuss and investigate alternative solutions for the mathematical tasks given to their students, they develop a clearer understanding of the potential problems and roadblocks that their students may encounter in their mathematical thinking. The development of a strong understanding of student thinking is the primary motivation for teachers to make changes in their teaching practices. Like the Japanese Lesson Study model, one member of the North Marion Lesson Study group taught the research lesson while the rest of the group observed student responses. Following the teaching of the research lesson, the Lesson Study group provided feedback, revised the lesson, and another teacher taught the revised lesson to another group of students. After the seven months it took to complete the Lesson Study process, the group prepared a report to be represented to their school board. Although the teachers involved credit the Lesson Study process for their improved reflective practice, increased collaboration, and awareness of anticipated student responses, they were highly critical of its time consuming nature.

In 2000, the Lesson Study process was implemented district wide in the Metropolitan Nashville Public School District by David Shearon, a member of the school board, who, after finishing

reading *The Teaching Gap*, declared “This is it! We have to create an ongoing structure to give teachers time to work on issues related to teaching and learning” (Boss, 2002, p. 14). It is not so much the district wide implementation of the Lesson Study process that is so unique about this case study, but rather it is the remarkable level of support the Metropolitan Nashville Public School board trustees provided to their teachers. Within three months of reading the book, the school board, moved from talking about Lesson Study to making a commitment to ensuring that Lesson Study would be successful for their teachers. They began by training their school administrators in the value of shared leadership within a school community. For Lesson Study to be successful, school administrators had to adjust their leadership style from an autocratic approach to a collaborative approach. School administrators, no longer to telling teachers what they should do, were empowering teachers to take ownership over their professional development.

Recognizing that teacher collaboration is not only time consuming but is also essential to the effectiveness of Lesson Study, the school board in Nashville began to renegotiate teaching contracts to provide teachers with “five half days and five full days of unstructured planning time, spaced throughout the 2000-2001 school year, devoted to Lesson Study teamwork” (Boss, 2002, p.14). In addition to providing teachers with collaboration time, the school district committed monies to cover the cost of the substitute teachers that would be needed to cover the classes of the Lesson Study group members when they were observing the teaching of the research and revised lessons. The Metropolitan Nashville Public School District has set an incredible example of how school boards can demonstrate their commitment, support, and understanding of

the necessity for meaningful professional development for teachers. The effectiveness of Lesson Study on the improving of teaching practices is substantially increased when there is support from school boards and school administration.

Although not to the same extent as the Metropolitan Nashville Public School Board, both the Bellevue School District in Washington State and Paterson School Number Two in New Jersey have worked hard to creatively generate solutions to the problem of finding the time for teachers to collaborate in the Lesson Study process. In the Bellevue school district, students are dismissed early on Wednesday afternoons to allow teachers time to work on professional development opportunities (Audette, 2004). Although it is optional for teachers to participate in a Lesson Study group, those who do not participate are required to attend more traditional professional development workshops. The teachers in the Bellevue School District have found that the Lesson Study process has not only improved their teaching practices in relation to student learning but has helped the staff to create stronger collegial connections. Teachers, who once felt isolated, were now feeling supported as a result of the time they spent together collaborating (p. 32).

At Paterson School Number Two in New Jersey, teachers who choose to participate in Lesson Study are provided with a two hour block of collaboration time during the school day every week for a twelve week cycle. Using a creative timetable, the Principal schedules the classes of participating teachers so that while the Lesson Study group is meeting their students are taking physical education, art, or music with other teachers. The Lesson Study process at Paterson School Number Two follows the Japanese

model with few modifications. Similar to schools in Japan, Paterson School Number Two hosts Lesson Study open houses inviting visitors to critique and observe research lessons. It took some time for teachers to be comfortable being observed by both visiting educators and colleagues. To ease anxiety, teachers were continually reminded that the observation phase was not to critique their individual teaching practices but rather it was to focus on student understanding in response to the research lesson (Stepanek, 2001).

Since 1999, the Lesson Study process at Paterson School Number Two has influenced how mathematics is taught in the school. Lesson Study groups, feeling frustrated by the incredible breadth and limited depth provided by most mathematics textbooks, have adopted textbooks with fewer topics and greater depth from countries such as Singapore. Using Lesson Study as a research tool, teachers were able to demonstrate to school administration how a more in-depth teaching of fewer topics would improve student mathematical understanding. Other Lesson Study groups revealed that many students were viewing math manipulatives as toys rather than learning tools. As a result, numerous cross grade Lesson Study groups formed to discuss how manipulatives could best be monitored and implemented into mathematics lessons so as to better assist student understanding. The findings from each of these Lesson Study groups and the use of manipulatives were streamlined throughout the school. The Lesson Study process at Paterson School Number Two has allowed teachers to take ownership of their professional development and to influence decisions regarding the methodology used to teach the curriculum.

Schools in Ontario, Canada are beginning to identify Lesson Study as a credible response to their concern that the extreme emphasis on standardized testing has had little effect on improvements in teaching practices and student learning. In his address to school board trustees, superintendents, administrators and teachers at the annual conference for the Elementary Teachers' Federation of Ontario, Brian Harrison (2004), the elementary mathematics curriculum consultant for the York Region District School Board in Ontario, addresses Canada's fascination with mandatory student and teacher testing. He argues that as a result of these limited measures, Canadian teachers and students are being denied meaningful teaching opportunities that promote deep understanding of mathematics. Harrison offers the Japanese model as hope for the Canadian education system.

The current Canadian obsession with standardized testing to ensure teacher ability and student learning is not unique. Many developing nations are employing the same measures, to varying degrees. So far, one country stands out for resisting the practice of mandatory student and teacher testing. Its teachers have refused to participate in either because of the limitations of these measures. Curiously enough, there has been little public outcry for mass testing or for the imposition of mandatory measures to enforce teacher competency. The name of this country? Japan. (Harrison, 2004, p.20)

In the winter of 2004, the York Region School District in Ontario implemented its first Lesson Study trial. Two hundred and eighty primary school teachers, working in groups of 8-12 were given the support of a curriculum consultant to facilitate the Lesson Study

process. Although the Lesson Study model implemented was virtually identical to the Japanese model in almost all aspects, it failed to allow for teacher input in determining the Lesson Study goal. Rather than focus on a goal generated by teacher concerns regarding student learning, the trial assigned each Lesson Study group a goal based upon the recommendations made by the Expert Panel Reports produced in 2003 by the Ministry of Education and Training.

The initial planning process involved intensive team and trust building among the Lesson Study group members. Each Lesson Study group had to establish protocol and set guidelines for discussion, feedback, and disagreement. To provide teachers with the time necessary for collaboration, the York Region School District received an Education grant from the Ontario Ministry of Education. Monies from this grant covered the cost of the substitute teachers and the consultants' fees. Harrison (2004) reports that due to the limited budgets of Ontario schools, not all teachers interested in Lesson Study would be provided with the same level of support, both in time and consultation with experts, as those teachers in the Lesson Study trial. Harrison is optimistic that by presenting the teacher and student responses of the Lesson Study trial to administrators and trustees, school boards will show their support of Lesson Study by appropriately funding schools so they can participate.

Lesson Study: What are the challenges and criticisms?

The testimonies of the teachers who have participated in Lesson Study indicate that Lesson Study has provided them with a clearer understanding of how students react to the instructional

strategies and materials used in classrooms. Using this understanding, teachers have felt more confident in recognizing and addressing the learning needs of the students in their classrooms (Harrison, 2004; Rock & Wilson, 2005; Stepanek, 2001; Audette, 2004). Because they can connect the relevance of Lesson Study to the work they do in their classrooms, teachers feel empowered and motivated to improve their teaching practice (Rock & Wilson, 2005; Boss, 2002; Viadero, 2004; Stewart & Brendefur, 2005). Since teachers are reporting that the Lesson Study process has allowed them to be collaborative, feel empowered, and to develop a deeper understanding of student learning, it asks the question why aren't all teachers using it?

Those opposed to Lesson Study express concern regarding the adoption of a Japanese professional development practice that is not part of the North American culture. Many educators believe that it is unrealistic to ask North American teachers to implement a Japanese professional development model when the culture of our schools and our society are very different. Similar to the assumptions that Tad Watanabe had about the teaching assignments of Japanese teachers, the critics of Lesson Study believe that the work load of North American teachers is far greater. This is a common argument and yet research would support that Lesson Study contains the key elements of effective professional development: collaboration (Schifter & Fosnot, 1993, Wood, Cobb, & Yackel, 1991), action research in the context of teacher's classrooms (Mewborn, 2003; Wood, Cobb, & Yackel, 1991), teacher led (Ball, 1997, Stigler & Hiebert, 1999), ongoing (Ball, 1997; Stigler & Hiebert, 1999), and focused on student learning in

response to teaching practices (Ball, 1997; Ball, 2000; Schifter, 2001; Stigler & Hiebert, 1999).

In contrast to the argument of cultural differences, the issue of time for teachers to collaborate in the Lesson Study process is a legitimate concern. Of the five case studies reported in this literature review only the Metropolitan Nashville School Board provided additional funding to schools to address concerns about teacher time and help make the implementation of Lesson Study as simple as possible. The remaining four case studies relied on creative timetabling, government subsidies, the willingness of teachers to use their own time, and early student dismissal to provide teachers with the time for collaboration. There is no easy solution to this concern. The issue of time for Lesson Study relies on the flexibility of teachers and the support of school boards and school administration.

A third concern is the development of trust and relationship amongst teachers to become comfortable in allowing their colleagues to observe the student learning in their classrooms. Because of the culture in North American schools, teachers associate observation with evaluation. Using Lesson Study, many schools have implemented lengthy professional collaboration sessions prior to the Lesson Study groups beginning their study. During these sessions, those observing the research lesson were taught not to be critical of the skills of the teaching teacher, but rather are to monitor the responses of students to the implementation of the research lesson over which the entire Lesson Study group has ownership. By discussing the protocol for collaboration and observation early in the Lesson Study process,

teachers found their anxiety surrounding peer observation eased. The teachers involved in the Lesson Study process found that the observation phase, although initially awkward, provided them with a clearer understanding of how to best provide instruction to improve the learning of their students.

Another concern often raised about Lesson Study involves the assumption that by creating the “perfect lesson” the creativity and individuality of teachers is minimized. Although the creation of the research lesson is the result of a collaborative effort, it does not imply a procedural format of “how to” for teaching. The research lesson, although not perfect, is to be a useful, realistic lesson that allows for the experimentation of alternative teaching practices. It is expected that this lesson, rich in curricular content, will be discussed, revised, re-taught, and reflected upon.

The research lesson provides the Lesson Study group with opportunities to observe and reflect upon the implementation of new teaching practices. Lesson Study allows teachers to become involved in what Wood, Cobb, & Yackel (1991) refer to as “classroom teaching experiments.” Teachers involved in Lesson Study have the unique opportunity to talk constructively and reflectively about effective teaching practices. It allows each teacher to reflectively gain insight into his or her own unique teaching practices and the learning of his or her students.

Given the experiences of those North American mathematics teachers who have used Lesson Study as part of their Professional Development, I will implement a similar case study in an Alberta school. By analyzing teacher conversations, observations, and reflections as they explore their professional development using

Lesson Study I will develop an understanding of Lesson Study as a tool for improving the mathematical teaching skills of teachers.

CHAPTER 3 – METHODOLOGY

Implementing Lesson Study as a Case Study

The purpose of this research was, in the context of a case study, to examine effective professional development using the Lesson Study model. In order to witness how the Lesson Study process could influence the teaching practices of mathematics teachers, there were very few modifications made to the implementation of the steps involved in the commonly practiced Japanese Lesson Study process. Within this research there were opportunities for the members of the Lesson Study group to adjust timelines, arrange a realistic meeting schedule, take direction of the Lesson Study meetings, and to creatively experiment with alternative teaching practices.

As the researcher, my initial role in this research project was to define the framework of the Lesson Study process and to provide support to participants when requested. The implemented Lesson Study process was not unique to this research project, however, it was unique to the educational setting in which it will occurred. As the Lesson Study evolved so did my role. Because one of the fundamental components of the Lesson Study professional development model insists upon the strength of the collective teaching expertise of the teachers in the group, I, after the initial two sessions, became a silent observer to the professional conversations and collaboration within the Lesson Study group meetings. In addition to audio recordings, I maintained a research journal to record and reflect upon the emerging themes and ideas that were evident throughout these meetings. Upon close examination of this data, it became clear that the themes

generated from the Lesson Study discussions were not of the voices of individual group members but rather might be better understood as representing a collective group voice. It is this collective voice that I choose to reference throughout my analysis of the Lesson Study group discussions. To honor the feedback of individual teachers within the Lesson Study I chose to conduct one on one exit interviews at the conclusion of the Lesson Study. During these interviews teachers were encouraged to share their reflections of Lesson Study as an effective professional development model.

Choosing the appropriate time to introduce Lesson Study to the school required careful consideration. Although the Lesson Study group did not official meet until September, there was be an informal teacher workshop on Lesson Study in the spring. During this workshop teachers were informed about how Lesson Study is implemented and the benefits it has had in improving teaching practices for various teachers in a variety of case studies. Following the workshop, any mathematics teachers who were interested in taking part in this Lesson Study research for the upcoming school year were invited to take a participant's information sheet and complete a participant's consent form. In a situation where there might have been more than four or five interested teachers, two Lesson Study groups would have been created.

In the fall, prior to beginning the Lesson Study process, members of the Lesson Study group were given the opportunity to share their teaching experiences, read and reflect upon articles, and gradually form relationships. As it was unclear, how familiar with one another the teachers in the Lesson Study group would be, time for several informal and team building sessions was allotted. This

strategy was in response to the Lesson Study case study performed in the York Region School District. The York Region School District found that the quality and honesty of the teacher reflections and observations increased by allowing teachers the opportunity to build a community of trust and respect prior to participating in the Lesson Study work (Harrison, 2004). It was determined that an early fall meeting of the Lesson Study group would be an excellent opportunity to discuss and negotiate the times and dates for Lesson Study meetings. As Lesson Study requires a considerable time commitment from teachers, a well established meeting schedule needed to be flexible enough to allow for interruptions and still remain structured enough to allow the Lesson Study process to maintain its momentum.

The Lesson Study Process being implemented

The Lesson Study process was to begin with the collaboration of a group of 4-5 teachers who would collectively identify a specific mathematics learning objective that was perceived as being as problematic for themselves and their students. Once the objective had been determined the Lesson Study group would then begin to research alternative teaching methods and resources as they worked to develop what they believed would be the “perfect lesson”, known as the research lesson. It was expected that the development of this lesson could be a lengthy process that would generate rich discussion and many revisions. Once the research lesson was created, one teacher from the Lesson Study group would volunteer to teach the research lesson to his or her students as the rest of the Lesson Study group observed. During the research lesson development, the Lesson Study group would determine the

specific observation criteria. While the research lesson was being executed, the Lesson Study group carefully observed and recorded the responses of students and the impact that the specific teaching practices being demonstrated had on their mathematical understanding.

Due to the isolating nature of teaching, most teachers are inexperienced and unfamiliar with observing one another. It was emphasized that despite the more common practice of observation as a tool for evaluation, the purpose of observing the research lesson would be to gather data about student learning in response to the teaching practices preplanned by the Lesson Study group. The lesson feedback data gathered would be invaluable to the Lesson Study group in the feedback and lesson revision sessions that would follow the teaching of the research lesson. To assist in the observation of the research lesson, the lesson study group worked together to determine what observation criteria and tools should be used. The group developed an observation sheet to track student verbal and nonverbal responses to teacher strategies (appendix A), a classroom seating plan, and copy of the detailed research lesson plan.

Following the teaching of the research lesson, the Lesson Study group met, and using their observations and reflections, revised the research lesson. Once the research lesson had been rewritten, another teacher in the Lesson Study group taught the revised lesson to their students. Similar to the teaching of the original research lesson, the remaining members of the Lesson Study group observed and recorded student responses. Upon completion of the teaching of the revised research lesson, the Lesson Study group met

again to reflect upon how successfully the changes in the original lesson were implemented. The Lesson Study group concluded their study by preparing a presentation of their experience to share with colleagues. The timeline of the meetings can be found in Appendix B.

Research Participants and Research Site:

How and why they were chosen

Lesson Study requires so much teacher direction that it is not something you want to manipulate people into doing. It goes no where without the interest, commitment, and hard work of teachers. (Lynn Liptak, Principal of Paterson School No. 2 cited by Boss, 2002, page 13).

Research Participants

As with any professional development opportunity, for Lesson Study to successfully influence teachers in making improvements to their teaching practices, teachers need to be willing participants. Although for this case study a school site had already been selected, if the teachers at the chosen elementary school were not interested in participating in this Lesson Study research a new site would have needed to be selected.

An informal Lesson Study workshop was offered in the spring to better inform teachers about the Lesson Study process; its implementation, time commitment, and evidence of its benefits from previous case studies. Following the workshop, any teachers who were teaching mathematics were invited to participate in a case study research project using Lesson Study. To help eliminate

any administrative pressure, teachers who expressed an interest in participating in the Lesson Study research identified themselves directly to me, the researcher. An ideal Lesson Study group would consist of three to five teachers. If fewer than three mathematics teachers from the school expressed interest, another Lesson Study workshop would need to be presented to the staff at another school in an attempt to invite more teachers to participate. If more than five teachers expressed an interest in this research, then two separate Lesson Study groups would need to be created.

Research Site

Redwood Elementary School, chosen as the primary site for this case study on Lesson Study, is a kindergarten to grade six school with approximately 220 students. There was one class of each grade and two behavior disorder classrooms. The staff was comprised of eighteen full-time and part-time members. There were five mathematics teachers teaching grades 4-6 making this an ideal site, should all five teachers volunteer to participate in this Lesson Study research.

As part of their prior school wide commitment to the establishment of a professional learning community, the teachers at Redwood Elementary School had been actively involved in “instructional walkthroughs” throughout their school. Instructional walkthroughs are informal collegial observations of teaching. Already familiar with peer observation and professional dialogue, Lesson Study would a natural next step for this staff. The majority of the staff at Redwood Elementary School was well established after having taught together for a number of years. They were very cognizant of the needs of their students and had a strong

understanding and knowledge of the academic history of individual students. It was this awareness that helped assist the Lesson Study group in preparing a research lesson that they believed would enable their students to comprehend a specific mathematics concept.

Redwood Elementary School had been chosen as the site for this Lesson Study research for a number of reasons. Perhaps the most important of these reasons was that it allowed teachers to volunteer without prejudice thus increasing the credibility of the research conducted. Because, as the researcher, I was not familiar with and did not have personal knowledge or connections to the students, parents, and teachers at the school, this research was performed without any preconceived expectations and biases. Therefore teachers' willingness to participate was due to their interest in Lesson Study and their commitment to improving their teaching practices.

Although I was not connected to the teaching staff at Redwood Elementary School, I did have a previously established collegial relationship with the principal. There was awareness that this friendship could be both an asset to this research and a potential hindrance. My relationship with the principal allowed me to access valuable insight into the community of the Redwood School. This insight was beneficial to the preparation of any communication with parents or questions that may arise throughout the Lesson Study process. This relationship with the Principal will also allow for relaxed and honest communication between me and the school administration. Despite the benefits of this relationship with the Principal, I needed to be cognizant of its potential harm to my

research. Perhaps the most critical area of concern was the ability for teachers to choose, free from administrative pressure, to participate in this research. Because of this validity of this concern, the Principal agreed that the names of teachers who chose to participate would not be shared prior to the first Lesson Study meeting.

Concerns regarding Ethics

While this research on the implementation of Lesson Study did not intend to put either the participants or the students at risk, there was a need to carefully evaluate and minimize these possibilities both during the research and in the publication of its results.

Concerns involving Participants

Anonymity

Throughout the implementation of this research on Lesson Study, field notes as well as audio recordings of the Lesson Study meetings were used to help identify how successful the Lesson Study process was in encouraging participants to make changes to the mathematical teaching practices they use. During these Lesson Study meetings teachers were encouraged to share their previous experiences using alternative teaching practices. Due to the potential of teachers sharing sensitive and personal reflections during these meetings, the confidentiality of participants needed to be protected. Specific names were not necessary in this research, therefore pseudonyms referring to persons and places were used in all communication about this research in order to ensure anonymity of all participants and the school in which they teach. By ensuring anonymity richer data would be obtained as participants became

more comfortable in offering feedback and revealing their reactions to the benefits of the Lesson Study process.

Participants' right to withdraw

The possibility of participants withdrawing from this research could have created potential problems both ethically and for the quality of the data the research obtained. Although the names of the participants were protected, if a participant had withdrawn from the research all of the data (i.e. field notes, observation notes, audio recording, and transcripts) provided by that individual would have also been withdrawn. This could have created difficulty if the basis of a recorded conversation was in response to a comment made by the participant who withdrew or if the participant was the teacher who taught the research lesson. Depending upon what point in the study individual participants chose to withdraw from the research, if the withdrawal of the participant interferes substantially with the quality of the data obtained, adjustments in the Lesson Study research may have needed to be made or the research may have had to come to an end.

Although participants could choose to withdraw from this research without prejudice, the quality of the Lesson Study process was dependent upon a specific number of group members. For the purpose of this research study, it was determined that there would need to be three to five teachers to make up the Lesson Study group. Should the group size have decreased to two or smaller, the Lesson Study process would have needed to be halted and the recruitment process begun again? Even though there was no prejudice for participants to withdraw, there was a possibility that if

too many participants withdraw the research with that particular Lesson Study group would have to end.

Time Commitment

James Stigler and James Hiebert (1999) identify the importance of recognizing the cultural nature of teaching when trying to implement change. Teachers not only have cultural expectations as to role of the mathematics teacher they also have, based upon their own experiences as students, expectations of how mathematics should be taught. Therefore, to help determine if Lesson Study was a useful professional development opportunity this research required a substantial time commitment from its participants. Interested participants would be notified, prior to volunteering for this research, that the Lesson Study group will start meeting, biweekly, in September with the expectation that the group be ready to teach their research lesson by February. But because Lesson Study is meant to be a professional development activity that empowers teachers, adjustments may have been needed to be made to the timeline and meeting schedule once the Lesson Study participants had been identified.

The extensive time commitment could have been a deterrent for participants. Lesson Study is believed to be a successful professional development opportunity because it is an ongoing process. So although there was room to negotiate the length and frequency of the Lesson Study meetings with participants, it was made clear that if there was too little time spent on Lesson Study it may lose its benefit.

Voluntary participation

The teachers at Redwood Elementary were under no obligation to participate in this research project. Their participation needed to be completely voluntary. One of the expectations of Lesson Study participants was that they feel ownership and empowerment over the professional development opportunities they were about to engage in. Lesson Study is a lengthy process that, in order to be successful, needs to be voluntary.

Initially there was concern that because this research on Lesson Study focused on both the improvement of mathematical teaching practices and emphasized the further development of professional learning communities, the administration in the school might apply pressure either explicitly or implicitly upon teachers to participate. To try and eliminate this risk, mathematics teachers, at the conclusion of an informal presentation, were invited to participate in this Lesson Study research project. Those interested were told to contact me directly rather than discuss their involvement with the school administration. Only after the Lesson Study group had been identified, was the administration made aware of those who had chosen to be involved.

Concerns involving students

Confidentiality

Although the majority of the work done during Lesson Study occurs outside of the classroom there was a concern regarding the confidentiality of the students who would be observed during the teaching of the research and the revised lessons. Throughout the observation of these lessons, members of the Lesson Study group were monitoring verbal and written student responses using

observation sheets designed by the Lesson Study group. To honor sensitivity surrounding student identity, the names of the students were replaced by pseudonyms in all communication regarding this research.

Observations by teachers

Another area of interest and concern involved the possibility of subjective observation of the research lesson by the members of the Lesson Study group. Because this case study involved a group of mathematics teachers from the same school, issues surrounding account of (what you see) versus account for (assumptions that are made) involving the teacher observation arose. Would the Lesson Study group be able to provide unbiased observations of student responses to the research lesson, of which they have ownership, to a class, where they already knew many of the students involved? This was a discussion topic that helped guide the group as they prepared observation criteria and generated a template to use for recording their observations.

CHAPTER 4 - RESULTS

Themes that Emerged As the Lesson Study Case Study Progressed

Time and Commitment

Although the purpose of this case study is to explore, identify, and reflect upon the Japanese Lesson Study Professional Development model as it is implemented within the setting of an Alberta classroom, one must first acknowledge the suspicion and reluctance of teachers to take upon a new endeavor.

The initial invitation for teachers to participate in this case study first appeared on the June 28th year end school staff meeting agenda at Redwood Elementary School as a discussion item entitled "Professional Development Research Project". With the school staff sitting at tables positioned in a horseshoe formation it was difficult to ignore the sideways glances that various colleagues shared with one another even before the informal research presentation had begun. Their expressions appeared to be asking "What are we going to asked to do now?" Perhaps trying to recruit and ignite teacher interest in the participation of a professional development project at the end of a long school year was a poor decision? Whatever the answer, the time allotted to this research presentation was a mere ten minutes so the disinterest of the audience would have to be dismissed, at least for the moment. For the next ten minutes the teachers at Redwood Elementary School were told of the methodology of the Japanese Lesson Study process; the benefits that fellow teachers had found it to have on their mathematical teaching methods; and the time commitment expected of them should they wish to be a participant in this case study.

Although the majority of the thirty three teachers present avoided direct eye contact when time came for them to ask questions, there were a few who took it upon themselves to advocate for the group. Issues surrounding the possibility of additional teacher preparation time for participants were addressed. Although teachers in Japan are provided with a half day each week to collaborate with their Lesson Study groups, the teachers at Redwood elementary would be expected to gather after school during their unassigned time. Schools such as Redwood Elementary have strict school based budgets to adhere to and providing additional staffing to support this research surrounding Lesson Study would be deemed as too costly. Upon hearing of how budgetary restraints would require teachers to essentially use their own time to work on this case study, the sideways glances returned once more.

The second issue involved the commitment of research participants to the schools' already implemented school wide instructional professional development. Questions, more directed at the school administration than me, inquired as to whether or not participants in this research would be excused from the school wide instructional focus professional development. If this same question was asked by a teacher in Japan the answer would have been a definite "yes". In Japan teachers determine what the focus of their professional development should be. The role of Japanese teachers in their professional development is one of respected professionals who independently have the responsibility to dictate which of their teaching practices they would best like to improve. In terms of teacher professional development there is little, if not no, administrative directive. However, in a school such as Redwood

Elementary the professional development opportunities for teachers look quite different from the Japanese model. The School District to which Redwood Elementary belongs has committed to district wide professional development. Included in this commitment is the implementation of a school wide instructional focus. It is the responsibility of school administration to, using the instructional focus, implement, oversee, and plan for the professional development of the school staff. By judging the tone and wording of the teacher who inquired about substituting his instructional focus professional development with the Lesson Study professional development it appeared there were feelings of frustration regarding previous professional development opportunities. Although school administration may be sympathetic to the feelings of the teachers, the School District had mandated that every school have an instructional focus therefore, any teacher who wished to participate in this Lesson Study research was to do so knowing that the previous professional expectations regarding involving in school wide professional development were to be continued.

The remainder of the discussion involved questions regarding grade level and teaching qualifications. The first inquiry was whether a teacher teaching grade one might be able to participate. Fearing that the number of participants might be low, division one teachers were encouraged to volunteer. It should be noted that although Lesson Study can be done with any grade level, this research was aimed more for division two teachers given that it is being conducted as a research project in preparation for a Secondary Education Masters thesis. The second inquiry was made by a staff member who was on a temporary contract replacing a teacher on maternity leave until the end of October. This teacher,

who was interested in participating in this research, wanted to know if the study would be completed by October 31st. As Lesson Study has no previous determined timeline, a definite answer could not be given. As exciting as it was to have a teacher interested in joining the Lesson Study group, trying to have volunteers who could participate to the end of the case study was important.

At the end of the presentation, teachers who were interested were provided with participation forms. Of the thirty three staff member in attendance, five immediately filled out and passed back the forms. And of those five, one asked to borrow a copy of James Stigler and James Hiebert's book *The Teaching Gap: Best Ideas from the World's Teachers for Improving Education in the Classroom (1999)*. It seemed that despite the apprehension of other members of the teaching staff, Redwood Elementary would have its first ever Mathematics Lesson Study group. As of June, this Lesson Study group would consist of the following five members:

David: a third year teacher who was assigned a grade 6 class for the upcoming school year. David had taught grade six previously and was concerned about his students performance on the mathematics achievement exam. He thought that Lesson Study might provide him with useful insight into the mathematical thinking and problem solving of his students. At the start of the upcoming school year, David's teaching assignment was altered from grade six to grade five.

Patsy: a grade four teacher who had been teaching at Redwood School for over 15 years. She had seen numerous administrative changes in that time and was looked upon as

a spokesperson amongst her colleagues. Patsy was keen to try new things and thought Lesson Study might be interesting.

Terry: an experienced grade five teacher who, for the second year, had taken on a teaching assignment in a division two behavioral disordered classroom. Her interest in Lesson Study was in response to her lack of confidence in teaching mathematics.

Stacy: a fairly young teacher who was team teaching with Terry in the Division Two Behavior Disordered Classroom. Stacy admitted from the very beginning that she felt pressure to join the Lesson Study group because Terry was choosing to participate. She also made it clear that she would come to the first meeting and make a decision after that. It was interesting to note that Stacy was also the same teacher who requested a copy of James Stigler and James Hiebert's book *The Teaching Gap: Best Ideas from the World's Teachers for Improving Education in the Classroom (1999)*.

Peggy: a grade six teacher who was new to grade six and to Redwood Elementary School. Peggy confessed that since arriving at Redwood Elementary she had felt disconnected with other staff members. She had hoped that perhaps Lesson Study might lead to further teacher collaborative planning beyond mathematics lessons.

During the following October, when it came time for the Lesson Study research to commence, the once interested and committed group of five teachers had been thinned down to only three (the two members who chose to drop out of this research gave

permission for their input to be used). Of the two staff members who dropped out prior to the start of the research project, only Patsy apologized and explained her reasoning to the remaining group members whereas David made excuses and promises to attend next time. For the next four months David never did make an appearance during the Lesson Study meeting or formally acknowledge that he was no longer interested. Although Patsy chose to back out of the Lesson Study research she did provide excellent insight into a major drawback of the Lesson Study process; the issue of time. Since our original meeting in June, Patsy's teaching assignment had been modified from a straight grade four assignment to a combined graded four/five classroom. Feeling overwhelmed and uncertain, Patsy explained that unless she was provided additional teacher preparation time or an honorarium to compensate for her involvement in Lesson Study she would have to decline. Patsy went on to describe how she felt the learning needs of the students in her classroom as well as her numerous extracurricular commitments were already monopolizing all of her time. Patsy's comments echoed similar comments made by some of her colleagues earlier in June. The argument was becoming clear, with many teachers regarding the demands on their time as unreasonable; teachers would realistically have to shelve voluntary projects such as Lesson Study despite the value it may have on their teaching practices.

I believe that in order for a Lesson Study group to have meaningful conversation and research surrounding a research lesson, the decision to participate must belong solely to teachers. This is a lengthy process and it should be made clear up front that once you are a part of the group you need to

stick it out to its completion. (Terry, personal communication, February 10, 2007)

With the Lesson Study group now down to three teachers, concern was mounting as to whether the group wanted to continue. During the first meeting, a candid conversation needed to occur as to whether the remaining members were in fact committed to the Lesson Study research project in its entirety. All three teachers confirmed their commitment.

Team Building and Collaboration

The first meeting of the Lesson Study group was relatively formal due to the very nature that Peggy, Terry, and Stacy were essentially strangers. In preparation for the awkwardness of this initial meeting, members were invited to bring along with them any teaching resources or activities that they have found to be favorites. Although a few of the resources were familiar to the others, most were not. For the next two Lesson Study sessions the group spent their time sharing, photocopying, and discussing teaching resources.

Towards the end of the third Lesson Study session Peggy, although unintentionally, confessed to the group that she felt insecure and apprehensive of teaching mathematics. She admitted that she herself, as a student, had struggled with math and that as a teacher she relied heavily on textbooks and teachers' resource manuals to guide her lessons. Terry responded to Peggy's comments with similar feelings about her own teaching of mathematics. Terry went on to say that it seemed whenever she finished explaining a math concept, to her students; every hand in

her classroom went up with questions leaving her feeling discouraged.

Stacy, the once skeptical member of Lesson Study research, was beginning to provide leadership to the group as she strongly advocated for the Lesson Study group to move forward. She described how reading James Stigler and James Hiebert's book *The Teaching Gap* (1999) had really motivated her to attempt to look at her mathematical teaching practices in a different way. Stacy went on to describe how listening to the mathematical thinking of students has influenced the teaching practices of mathematics teachers in Japan. As Stacy spoke the other group members asked her questions about regarding the differences between the role of the teacher in American mathematics classrooms as compared to the role of the teacher in Japanese mathematics classrooms. An informative conversation began regarding the new mathematics curriculum and what so called constructivist learning looked like. Despite the countless years each of these teachers had spent in front of their classes teaching mathematics none of them had had experience or knowledge in planning or executing a constructivist lesson. They confessed that the beautiful and expensive manipulative kits that had been purchased for their classrooms were used by students more as toys during free time rather than as essential learning tools during math class. As the conversation continued so did the story telling, laughter, and team building. There appeared to be a connection forming amongst the group members as they acknowledged relief in recognizing that not everyone was comfortable implementing the new mathematics curriculum. Towards the end of this session, Terry asked if the group might like to work together in planning a research lesson using

manipulative kits. She described how it might be an excellent opportunity for them to work together and plan a lesson using a math strategy that they each felt uncertain of. The other Lesson Study group members seemed keen. Finding commonality in the weaknesses of their mathematical teaching practices appeared to be laying the foundation for relationship and possibly trust amongst the Lesson Study group members.

Developing Trust

Once the Lesson Study group decided to generate their research lesson using a mathematical teaching approach that was not commonplace in any of their practices, enthusiasm and uncertainty ensued. As none of the three teachers had ever taught a lesson using a constructivist approach, the Lesson Study group had questions as to how they should even begin to start their research. At this point the Lesson Study group was asked if they might consider experimenting with an open ended problem as a basis to the development of a research lesson. As the group pondered this suggestion there was silence. Finally the silence was broken when Terry, at the risk of sounding ignorant, courageously inquired as to what an open ended problem was. No sooner had Terry finished her question when both Stacy and Peggy, beginning to relax, admitted that they too had no idea what an open ended problem was. After two months of working together, the three members of the Lesson Study group were beginning to trust one another enough to confess their lack of knowledge regarding mathematical understanding and teaching strategies. The conversation that followed was truly one that warranted the use of the expression regarding flood gates opening.

Each of the three Lesson Study group members took turns confessing to the lack of mathematical understanding that they, as teachers, had. For Terry, her own experiences in elementary school had created such negative feelings towards math. She remembered her teacher demanding that all math lessons be written perfectly in pencil in a lined notebook. She recalled how the numbers had to be lined up in perfect formation and that if an error was made, no evidence of eraser markings were acceptable. She talked of how her teachers would clip the corners of math notebooks when there were no further corrections needed to be made, and how she often spent days working on corrections so that her notebook would look like those of the other students. Terry also confided that because she lacked creativity when teaching math in her classroom, she often resorted back to the same demanding teaching practices that her teachers had placed upon her.

Feeling united by the experiences Terry shared, Peggy talked about how she started every math class with timed math drills thinking that these drills would increase her students' recall of basic math facts. She went on to describe how all of her math lessons were structured in the same manner. She began with timed basic facts sheets, did a homework check, followed by teacher instruction on the whiteboard, and any remaining class time students were to use to independently work on worksheets. Peggy admitted that she knew her math classes were boring but that with the countless student needs in her classroom she was at a loss as to how to create a lesson that would include everyone. Peggy believed that for her students mathematics lessons should be highly structured and teacher directed. When it came time for Stacy to share, she sheepishly admitted, that as a high school student, she

had found math to be very difficult. Because her math grades were so low, so did not complete her high school matriculation math courses. Feeling like a math failure, she purposefully stayed clear of any math related courses when she reached University. Stacy told the group that she had never relayed to her colleagues her experiences of failure as a math student. Stacy had assumed that because the teachers she had worked with so skilled, they must be experts in all of the curricular disciplines that they taught. Stacy explained how when she went to math professional development sessions, she felt as though she was the only teacher in attendance who couldn't comprehend the math concepts well enough to decipher the presenter's suggested teaching strategies. Stacy dreaded teaching math so much that in her planning she would often leave it until the end of the morning hoping that the previous morning activities might extend into math time, thereby forcing her to cut her math lessons short. Through listening to the progression of the sharing and story telling between the Lesson Study group members it became noticeably clear that trust was establishing amongst them.

For the two sessions following the initial teaching of the research lesson, the Lesson Study group developed into a community of mathematical learners, as they analyzed and shared their observation notes. They looked at the specific student responses to both the questions the teacher asked and the reactions to the comments shared by their classmates. Stacy pointed out that as the lesson went along and the students realized that Terry wasn't going to tell them the answers, they began to rely on, and listen to one another. For Stacy, this was evidence of the beginning of a community of mathematical learners amongst

Terry's students. As Stacy's comment began to settle in, Peggy had a revelation. Could not the same be said of their Lesson Study group? Were they not becoming a community of mathematical learners as they collaboratively looked at and experimented with alternative mathematical teaching strategies? Were they not encouraging and supporting one another to try a new teaching practice in their classrooms? Both Terry and Stacy agreed. As a researcher, I found this realization very exciting.

Although it had begun to appear as though the Lesson Study group would almost completely abandon their notion of allowing students to create their own knowledge using the open ended question prompt, Peggy's insight encouraged the group to continue with the previously planned research lesson making only minimal revisions.

Taking Risks: researching and experimenting

Up until now I have been teaching directly from the teachers' manual. The problems and questions I provide to my students are straight from their textbook. I do try and have some discussion both before and after my formal teaching section of my lesson, but not all my students participate. With teaching an achievement exam grade I worry about getting through the curriculum. Although I agree that students should be provided with opportunities to explore and create their own understanding of mathematical concepts, I still believe there is a place for the teacher to provide and correct student knowledge. But based upon how I observed my students respond to the revised research lesson, I would like to incorporate more partner work using open ended problems

into my lessons. I won't be abandoning the textbook or teachers' manual, but I would like to experiment, either at the beginning or the end a unit, using a lesson similar to the one we developed in this Lesson Study. (Peggy, personal communication, February 10, 2007)

Although the previous Lesson Study session resulted in little discussion regarding the planning of the research lesson, the group did make a commitment to least explore open ended problems. At the start of the next Lesson Study session the group decided to explore what constructivist learning, and more specifically open ended problems, looks like in a mathematics classroom. Peggy, a recent graduate from University brought in her Mathematics Curriculum and Instruction course textbook to help guide the group. Peggy had read an underlined passage to the group, "The most widely accepted theory, known as constructivism, suggests that children must be active participants in the development of their own understanding. Constructivism provides [teachers] with insights concerning how children learn mathematics and guides [them] to use instructional strategies that begin with children rather than with [themselves]." (Van de Walle & Folk, 2005, 22). Having never before seen this textbook, both Terry and Stacy studied through the book by silently turning pages and glancing at the authors' suggested activities. Rather than provide examples and support of how their research lesson might look, the textbook seemed to be creating anxiety as each teacher shared concerns as to how her students might behave during a math lesson that was not completely teacher directed. For the first time the Lesson Study group began to shift their discussions around how their research lesson would impact both their students' behavior and their learning. Once again

returning to the Van de Walle & Folk's textbook for guidance, the Lesson Study group researched and discussed possible activities that could be perceived by their students as an extension of other activities that they have enjoyed. Terry and Stacy began the discussion with a description of how their students loved to build with Lego. The group brainstormed and debated over what might be some open ended mathematical problems that made use of Lego. As the discussion evolved, the use of Lego led to the use of money. What could be an open ended problem that would incorporate both Lego and money? Peggy suggested using both as units for a measurement activity. For the next two sessions the group wrote and rewrote open ended problem prompts involving measurement, Lego, and money. As they drafted and redrafted, the group focused on what might be the responses from their students to the prompts. How the prompt should be worded; how much information should be provided; how should the student data be recorded and shared; and what would be the role of the teaching during the lesson? Terry spoke candidly when she admitted that she found it a challenge to allow students who were struggling to work things through on their own. She felt it was her responsibility, as a teacher, to rescue these students from their frustration by telling them the answer. Although the others had experienced similar feelings, the group realized that the best way for them to observe how the students were responding to the research lesson was by deliberately not providing students with the answers or for that matter providing them with methods to best find the answers. By not telling, the teachers believed they would gather valuable insight into the mathematical understanding of their students through the observing of the strategies independently

implemented and through the types and quality of the questions asked.

At no point during the previous two Lesson Study sessions was it decided what mathematical curricular strand the group was preparing their research lesson for. In essence, the Lego was dictating the activity, and the activity was dictating the curricular strand. It was as though the Lesson Study group was so excited and keen to try a new teaching strategy with their students that they had overlooked the curriculum. Once this observation was pointed out to the group, the next Lesson Study session began with a focus on specific curricular connections and the timing of the research lesson within the framework of the teachers' year plans. The group, still intent on using Lego, money, and measurement, decided to plan their research lesson using the objectives outlined in the curricular stand: large numbers. With the focus now on large numbers, the group set out to design an open ended problem prompt that would allow students several entry points; exclude the telling of any problem solving strategies; and be void of any mathematical terminology such as calculate and estimate. Although the creation of such an open ended problem task initially appeared to be simple, this group of teaching practitioners, who had only taught math using teacher-directed strategies, struggled. Each revision of the question prompt needed careful consideration of both the task and the predicted interpretations of students when presented with the task. Terry and Peggy both wrestled with keeping the wording of the task simple, whereas Stacy grew frustrated by the planned lack of teacher provided guidance for problem solving. At one point Terry suggested to the group that they take a risk and provide a simple open ended question prompt

and if the first group of students struggled too much, the Lesson Study group could make some changes during their research lesson revision. Through consideration of Terry's suggestion, both Peggy and Stacy agreed with Terry even though they remained uncomfortable with the lack of teacher instructed learning in the research lesson. This group of teachers would become risk takers and use this Lesson Study opportunity to teach a lesson, trying something that was not only new for their students but also new to their teaching practices.

Eventually after four months of meeting biweekly to research, collaborate, and prepare, the Lesson Study group determined that their research lesson was ready to be taught. The Lesson Study group had created an open ended mathematical question prompt, involving estimation and large numbers, into a thoughtfully scripted into a lesson. The group hoped, based upon the mathematical responses of the students, that this lesson would encourage them to implement similar lessons into their own mathematical teaching practices. Prior to the implementation of the research lesson, the group met to again to review their role as either the teacher or the observer. The teacher, Terry, was reminded to stick to the teacher script and that the research lesson created relied on her not giving students any suggestions about how to solve the problem. The observers were reminded that they were not to intervene in the teaching of the lesson or to prompt student learning. Although the group was anxious to put their hard work and preparation into action, there was apprehension as to whether or not they could keep their commitment to their collectively created research lesson.

The frustration in teaching using a scripted lesson

I'm not sure that this is a drawback or more of a personal frustration but I found the notion of being observed while using a scripted lesson to be difficult. When we observed Terry's lesson, I found it difficult to just observe students as they attempted to solve the problem we had created for them. I wanted to question them about their strategies and encourage them to elaborate their ideas further with their group. Not being able to jump in when a student was struggling left me feeling helpless. Observing students as they engage in a lesson without being a part of the teaching is not something we do very often as teachers, especially when the lesson presented is one that we spent months to develop. Although I found observing to be difficult I found being observed even worse. Knowing that I had to execute a lesson exactly as we had planned whilst Terry and Stacy wrote frantically on their clipboards caused me to panic. Perhaps it is because I am a new teacher that I associate lesson observation with teacher evaluation. I know that Terry and Stacy were there to observe the students but still I stumbled on my words, gave poor directions, and forgot what I was doing once or twice during the lesson. Having colleagues in the classroom to observe student learning and not my teaching is not something I am familiar with, it's going to take me some practice to get used to. (Peggy, personal communication, February 10, 2007)

According to the Lesson Study Process, there is opportunity for the Lesson Study group to reflect and evaluate how the research

lesson met their learning goal. Feedback began by describing how they felt the lesson went, both for themselves and for their students. Stacy spoke first by retelling the various student conversations she had overheard. She was amazed at the way the students communicated with one another, listening first and then testing an idea. Peggy spoke of how even though in the research lesson the Lesson Study group had specifically chosen not to reveal mathematical terminology, some students were creating their own vocabulary while others were accurate in their word choice. Peggy said that having the opportunity to observe a lesson that she had taken part in planning was a rewarding experience. As Stacy and Peggy shared how they were energized and excited by the responses, questions, and problem solving strategies they observed, Terry expressed frustration with teaching the lesson. She felt that by not providing specific teacher directions to the problem and by allowing students to make and defend their conjectures, she was at a loss as to what her role was. She explained that she had spent the previous evening memorizing the research lesson instructions she was to give and the wording of the questions she was scripted to ask. All throughout the lesson she was more concerned and focused on how the Lesson Study group expected her to teach rather than on the students she was teaching. She questioned the others, as to how a carefully crafted and scripted research lesson, created over three months, was demonstrating good teaching practice? Although Peggy was sympathetic to Terry's concern, she reminded Terry that this research lesson was not only the first time that any of them had ever collaboratively created a scripted lesson it was also the first time any of them had used this particular teaching strategy. Peggy went on to suggest that perhaps, had

they chosen to use a teaching strategy that was familiar to each of them, teaching the research lesson may have seemed more natural. Following these words, the group began to look for ways to revise the research lesson using these suggestions. The group decided that before revising the research lesson it might be wise to determine who was going to teach the revised lesson. The thought was to tailor the revised lesson to be more suitable to that teacher's comfort level. It appeared that experimenting with teaching practices needed to be reflective of both the teacher's unique teaching style and the learning needs of students.

As the researcher, I found value in listening to the dialogue of the teachers in the Lesson Group as they, during the preparation of the research lesson, openly shared their criticisms and appreciation for the Lesson Study process. By being the silent observer throughout the four months that the Lesson Study group met, I was provided the opportunity to develop insight into the struggles and successes that the Lesson study model can provide for teacher professional development.

CHAPTER 5 – DISCUSSION

While the literature provided details of the success of Lesson Study, it wasn't until I was permitted access to the professional conversations of the Lesson Study group members that my understanding of the process evolved. Witnessing the teachers in this case study as they collaboratively researched and prepared a lesson that demonstrated unfamiliar teaching practices was encouraging for both the teachers and for my research. The honest dialogue and reflections of group members as they explored mathematical teaching practices provided incredible insight when I began to wrestle with and formulate the answers to my research questions. Using my analysis of this case study, I believe that Lesson Study is the professional development model that I had initially felt was needed for my colleagues in schools. Lesson Study was seen as a professional development opportunity that provided the teachers in this case study with a structure that allowed them to experience empowerment and enthusiasm as they reflected upon, and modified, their teaching practices. Providing clarity to these claims involves a return to the initial questions that prompted the development of this research. Beginning with an analysis of the Lesson Study process as an effective professional development model, this research lends itself to explore what might be the potential drawbacks and benefits. The examination of these research questions invites a conversation as to implications that the findings from this case study could have on the professional development practices of teachers.

Research Question #1: Is Lesson Study an effective Professional Development model?

While the literature identifies and celebrates the success of the professional development of mathematics teachers who modeled their professional development using the Lesson Study process identified in the work of Stigler and Hiebert (1999), it still lends itself to a critique of its effectiveness using criteria outlined by the educational research conducted by Cobb, Wood, & Yackel (1990), Schifter and Fosnot (1993), Ball (1997), and Mewborn (2003). In essence, does the Lesson Study process provide a professional development model that allows for teacher collaboration? Does Lesson Study provide a space for teachers to make connections between their professional development and the specific learning needs of the students in their classrooms? Using Lesson Study, are teachers able to experiment, reflect upon, and modify alternative mathematical teaching practices with their students? Does Lesson Study empower teachers to make decisions regarding the focus of their professional development independent of administrative agendas and interventions?

To help provide clarity in the answering of these questions a case study, involving three Canadian mathematics teachers, was established. The Lesson Study process implemented modeled the Japanese Lesson Study process outlined by Stigler and Hiebert (1999). The three teachers involved in this case study were voluntary participants who were intrigued by the unique opportunity to create and lead their own mathematical professional development. During the four months that the members of the Lesson Study group worked and learned with one another, special

attention was given to their conversations. Using these case study conversations, the purpose of this research was to determine if Lesson Study is an effective professional development model.

Opportunity for collaboration

I appreciated being a part of the creation of a mathematics professional learning community. We talk about Professional Learning Communities during our Instructional Focus professional development but being part of this Lesson Study has really shown me how beneficial they can be. I joined the Lesson Study research group because I felt isolated in my classroom. Redwood Elementary School has a relatively small population. As a result, I am the only grade six teacher on staff. Being new to the school and not having another grade six teaching partner to plan units with means I do most of my work alone. Although I really have enjoyed my students, I miss adult interaction and having someone to bounce teaching ideas off of and to share resources with. I have found the relationships we formed in our Lesson Study group to be just what I needed. I am hoping that we will continue to work collaboratively now that this Lesson Study research is over. (Peggy, personal communication, February 10, 2007)

Opportunity for teacher collaboration was a rare experience for the teachers in this case study. Each of these three teachers was assigned 1430 minutes of classroom instructional time each week. Recognizing that students are required to receive a weekly total of 1520 instructional minutes, the teachers used the 90 minutes of unassigned time for their lesson preparation and marking (Edmonton School District, 2007). It should also be noted that in the

school where these teachers taught, the 90 minutes of unassigned time was broken down into three thirty minute time blocks scattered throughout the week. None of the teachers in this case study had overlapping preparation time that would have allowed them to collaborate with one another. The teachers in this case study claimed that their 90 minutes of weekly preparation time was so sacred that during this time they preferred to work, uninterrupted and isolated in their classrooms. Teacher collaboration during preparation time was not happening.

In addition to the 1430 minutes of assigned weekly classroom instructional time, administrators are also able to dedicate 345 minutes of non instructional time to a teacher's duties (Edmonton Schools District, 2007). It is during this assigned non instructional time that the participants in this case study were expected to do supervision, participate in committee work, attend staff meetings, provide extra curricular activities for students, meet with parents, and attend school wide professional development sessions known as "Instructional Focus Work". It appeared that the only opportunity for the teachers in this case study to collaborate was during their Instruction Focus Work sessions. When asked about the quality and amount of collaboration during these sessions, all three of the teachers indicated that they found these sessions to be a poor use of their time. It was revealed that each week a consultant would provide a ninety minute seminar on reading for understanding, the instructional focus for Redwood School. Any instructional strategies provided were done so by the consultant and were not generated by the staff. If an opportunity was provided for teachers to collaborate with their table partners, it was often very time restricted and was conducted through the use of carefully worded guiding

questions that would provide the consultant with a lead in to the next topic in the preplanned presentation. Although it appeared as though the teachers were involved in collaboration, meaningful sharing during these school wide professional development sessions was not happening.

When the teachers in this case study had their first Lesson Study meeting, the notion of teacher collaboration as part of professional development was confusing. Although, having spent a number of lunch hours eating beside another in the staff room, they had developed collegial connections stemming from the sharing of family stories, weekend plans, and humorous holiday memories; they had little to no experience with professional teacher collaboration.

Each Lesson Study group meeting began with the three teachers sharing with one another. Because the meeting occurred after school, they began by sharing the humorous and frustrating experiences that they had encountered during the day with their students. As each of the teachers identified with the others, there was a great deal of laughter and enjoyment in the story telling. Having the time to share and make connections with one another helped to build relationships amongst the group. Although the conversation about the events of the day was not directly related to the Lesson Study research, it became essential in the development of a foundation of trust and community.

Over time the sharing of days' teaching experiences emerged from story telling into the sharing of discipline strategies and teaching resources. This emergence was the perfect segue for teachers to begin to talk about their teaching practices and to

make connections with the alternative teaching practices they would like to implement. Making the transition from having personal conversations to having professional conversations took time and patience. Having awareness that the teachers involved in this case study had never experienced an extended amount of time in dialogue with one another was critical. It was important not to pressure or limit their conversations. Of the four months dedicated to this case study, it wasn't until the fifth session that the Lesson Study group members began to feel comfortable enough to admit to one another their weaknesses as a mathematics teacher and start to seek support and input from the group. As trust began to develop so did the Lesson Study. Once the group members began to look at what they identified as weakness in their teaching practices, discussion surrounding the development of a research lesson began. More than once members of the group talked about how they were willing to try something new. Although the Lesson Study sessions still began with story sharing, these stories were becoming less humorous and more reflective as teachers told of how they were beginning to recognize how specific teaching strategies might benefit various students. Where teacher stories were once entertaining retellings of events, they were now becoming an essential part of reflective practice.

As the nature of the conversation during the teachers' collaboration changed so did the influence that Lesson Study was having on the creation of a mathematics professional learning community. The teachers in this case study who were previously more familiar and comfortable with working in isolation were now, through the guidance and support of their colleagues, exploring and reflecting upon how to best implement changes into their

teaching practices. It was clear that the Lesson Study process did indeed provide the teachers in this case study with the opportunity to collaborate with their colleagues in rich meaningful professional conversation.

Opportunity to make direct connections to the teaching and learning of students in their classrooms

Through observing students and focusing on the different types of problem solving methods they used I was amazed at which students would give up easily on the problem and look for someone else to tell them the answer. I had expected the higher achieving math students to really excel during our research lesson and it turned out to be the lower achieving students who persevered. The high flyers in my class seemed to be lost without the specific teacher directions that they have come to expect. It makes me question what level of mathematical understanding these high achieving students truly have. Do they understand the concepts or have they simply memorized what steps they should take to get the right answer? I enjoyed comparing how my students responded to our research lesson as compared to how Peggy's students did. I had assumed that because Peggy's students were in a mainstream grade six class and mine are in a behavior disordered classroom that her students would find the problem we created too easy. I was amazed to see that my students were open to new ideas and worked well in groups whereas Peggy's students, who may have sat together in groups, seemed to prefer to work in isolation. All in all I would have to say that my students were better collaborative problem solvers than I had thought. They managed to stay on task for 45 minutes without incident. I am suddenly realizing that my class can and

should be exposed to more hands on open ended problems. I have clearly underestimated their abilities; either that or I have become far too comfortable directing the learning in my classroom. (Terry, personal communication, February 10, 2007)

One of the attractions to the implementation of the Lesson Study process is the guided structure teachers can follow when implementing and reflecting upon how various teaching strategies benefit the specific learning needs of students. The Lesson Study group, in this research, began with a discussion regarding how disappointing it was that their students were struggling to verbalize their understanding of mathematics. Student difficulties with problem solving seemed to be a reoccurring theme amongst the group. Why were students struggling with problem solving? What did these students really know about the types of problems they were solving and how the answers connected to the question?

The teachers began to spend time sharing and analyzing student work looking for evidence of mathematical understanding. They looked at the language being used as well as the computation strategies being demonstrated. The group concluded from their analysis that their students were very good at following directions and producing mathematical answers to a problem but were very poor at providing a clear explanation or written diagram for their method. As the conversation evolved from examining student work to exploring teaching practices, it became evident to the Lesson Study group that in order to help their students develop a stronger understanding of mathematics; they needed to take a closer look not only at their mathematical teaching practices but also at the role of the teacher in mathematics lessons. Were they

providing their students with the opportunity to explore mathematical problems together? Were they providing open ended mathematical problems that would allow students to create their own solutions and explore the outcomes? Were students permitted time to work through problems independent of teacher assistance and direction?

As the Lesson Study group began to work through the answers to each of these questions they put together suggestions as to what their research lesson might look like. The group started to research various teaching practices and predict how their students might respond to these methods. Extensive preparation and reflection was used to develop and script a research lesson that the group thought would best help address the mathematical problem solving concerns of their students. Once the carefully crafted research lesson was created, the Lesson Study group developed criteria for the observation of the lesson. What information was the group most interested in? This step required an equal amount of consideration as had been put into the writing of the research lesson. Were there specific students that the teacher was interested in the observers watching? Was there certain vocabulary or instructions in the research lesson that was new to the students, and if so, how did they react? How did the research lesson influence the problem solving strategies implemented by students? Did the students' use of mathematical language change? How did their work resulting from the research lesson differ from previous lessons? How did individual students react when the previously established role of the teacher was changed from one of knowledge giver to facilitator?

Using these observations and samples of individual student work, the Lesson Study group was able to once again return to the original research lesson and look for ways to make adjustments. Discussion regarding the conversations of students and strategies that were tried throughout the research lesson provided the group with an enhanced awareness that student mathematical understanding is not always accurately documented in student work. The teacher was not always able to hear and see the mathematical conversations and strategies implemented by students. Using the data in the observation notes and the insight provided by the observing members of the Lesson Study group, the teaching group member was rewarded with valuable information regarding students' mathematical learning that may not have otherwise been noticed. It is this information that allows for teacher reflection in the modification and implementation of future teaching practices. By allowing the teachers in this case study to first focus on the mathematical learning needs of the students in their classroom, and then research alternative teaching practices to best meet these needs, Lesson Study has proven to provide excellent opportunity for teachers to make direct connections to the teaching and learning of students in their classrooms.

Opportunity for the teachers involved to research and experiment with new teaching strategies in their classrooms

Trying new teaching practices was so rewarding and yet it was something I probably wouldn't have initiated on my own. With teaching the grade six math curriculum for the first time I was closely following the teachers' resource manual in my daily lessons. Whatever question prompts the manual suggested;

those were the ones I used. Being a fairly new Education graduate I was familiar with the development of elaborate lesson plans that allowed students to create their own understanding. Unfortunately I had not implemented these same teaching strategies in my professional life, at least not until this research study. Because I am teaching a new curriculum in a new school, the amount of time and commitment I have to creatively plan my lessons is limited. In reality, I am just one day ahead of my students and it is easier to just follow the textbook. Collaboratively developing this research lesson, using teaching strategies none of us had ever attempted before was so rewarding. Stepping out of my comfort zone with two of my colleagues, whom I regard as exceptional teachers and mentors, was easier than I thought. I'll admit that I was apprehensive as to what reactions my students might have to the lesson or more importantly how they might behave during the lesson. Taking risks in the implementation of new teaching practices is not something I have experience doing. I think I am more of a playing it safe and keeping it calm type of teacher. Although, after observing the interactions of my students as they discussed and problem solved together during the research lesson, I can see myself planning more activities like this one. (Peggy, personal communication, February 10, 2007)

By providing the teachers in this case study with the opportunity to make direct connections to the teaching and learning of students in their classrooms, the Lesson Study process encouraged them to research and experiment with new teaching strategies in their classrooms. Although the research lesson they created

required substantial time to research and prepare, it allowed the participants to thoughtfully plan and reflect upon how the implementation of these new teaching strategies would benefit the mathematical learning of their students. Amongst the Lesson Study group members there was extensive discussion concerning the specific details of the research lesson. To allow for optimal teaching and learning, the group thoughtfully orchestrated the sequencing of the lesson, the format for students to demonstrate their learning, the pacing of the lesson, the use of vocabulary, and the specific wording of teacher questioning. Essentially the Lesson Study group members created a research lesson that they considered to be the “perfect lesson” (Stigler and Hiebert, 1999).

After extensive research and discussion, the initially reluctant participants chose to devise a research lesson that involved the implementation of a mathematical teaching strategy of which none of the group members had had any prior experiences. Wanting to focus upon the mathematical understanding of their students when problem solving, the Lesson Study group admitted that they needed to try new mathematical teaching strategies unlike the ones they were presently using. They determined that these new teaching strategies should allow their students the opportunity to work collaboratively as they create their own mathematical understanding of a problem. It was agreed that the research lesson would ask students to respond to the math problem by physically demonstrating and verbalizing to the class what mathematical strategies they had tried and which ones they believed were the best. In addition to the structure of the research lesson, the Lesson Study group discussed how the role of the teacher would need to be as a facilitator and not as a knowledge

giver. It was decided that the research lesson teacher was not permitted to hint at, suggest, or provide solutions to students when attempting to solve the math problems. This student directed constructivist research lesson, that included open ended word problems and manipulatives, was very different from the teacher directed lessons each Lesson Study group member had traditionally used in their daily teaching practices. Researching, implementing, and experimenting with new mathematical teaching practices provided a unique and valuable risk taking opportunity for these three teachers who had previously confessed that they were not comfortable teaching mathematics.

Judging by how well my students responded to the group problem solving and discussion, I would try to include more activities similar to this one in my lesson planning. The ideas and problem solving suggestions that my students came up were far more inventive than any I would have offered to them. I am already researching ways I make better use of the manipulative in my classroom. Although I can't promise that huge changes will happen overnight in the mathematical teaching practices I use, I do feel excited to at least try and implement some new ones. (Terry, personal communication, February 10, 2007)

When, at the conclusion of this research, participants were asked about the benefits of using Lesson Study as a professional development model, each made mention of how much they appreciated the opportunity to research and explore alternative mathematical teaching practices. They identified how collaboratively looking at specific mathematical teaching practices

along with the specific learning needs of the students in their classrooms helped to strengthen their reflective teaching practices.

I'll admit that I like to have my students working quietly and independently. I associate student chatter with off task behavior. Because it is how I was taught math, it is how I feel most comfortable teaching. However after observing students, in groups, first working and discussing solutions to a problem and then demonstrating to the class what strategies they used, I can see some definite benefits to doing more lessons like this one. Listening to students verbalize their solutions and methods to reaching their solutions provided me with far more evidence of their mathematical understanding than doing the twenty question homework check I do at the start of each class. Although I may not yet know how much, this experience using Lesson Study will definitely have an impact on how I teach math. (Stacy, personal communication, February 10, 2007)

Although it isn't clear whether the Lesson Study participants will choose to adopt the specific mathematical teaching practices used in the research lesson, what is apparent is the willingness and openness of each group member to critique their own teaching practices, research alternatives, and make changes.

Empowered to determine what changes were needed in their mathematical teaching practices

I really appreciated the ongoing nature of using Lesson Study. It is rare that, as teachers, we get to spend some much together sharing resources and discussing teaching practices. Most professional development sessions involve teachers being

talked at by a consultant who gives everyone a handout and never once asks what the specific learning needs of the students are in each teacher's classrooms. How can the type of professional development we have come to expect really connect with the learning needs of students in a room of thirty of more teachers? During the past four months I have left every one of our Lesson Study sessions looking critically at the quality of my teaching. The sharing that we have done in our group has really caused me to take a deeper look at why I use the teaching practices I do in my classroom. (Terry, personal communication, February 10, 2007)

Initially the Lesson Study group was reluctant to acknowledge or examine their mathematical teaching practices. There were two group members who avoided disclosing to the other members their feelings of insecurity and disappointment surrounding their teaching practices. It wasn't until relationships and trust amongst the group had been established that these emotions began to surface. It was once the Lesson Study group initiated open and honest dialogue regarding their experiences, both as math students and as math teachers, that they began to narrow their focus on the specific teaching practices that they would like to experiment with during the research lesson.

Two such teaching practices were the implementation of collaborative open ended problem solving and student directed learning. Having no experience using open ended problem solving in their lessons, the teachers put substantial time and effort into the research and discussion surrounding what specifically constituted as an open ended problem. After the group reached a consensus

regarding the definition and purpose of an open ended problem, their next step was to decide upon the specific wording of the problem. Using this thoughtfully crafted open ended problem, the Lesson Study group debated and discussed what might be anticipated student responses and the dynamics surrounding the facilitator role of the teacher during the lesson.

Anticipating student responses to the mathematical problem created, resulted in the teachers talking about the learning styles of individual students in their classrooms. By reflecting upon how students may approach the problem and what guidance might be needed, a conversation surrounding the role of the teacher evolved. Discomfort grew as the teachers realized that their research lesson would not only be asking them to introduce an unfamiliar open ended problem, it would also ask them to step out of the role of knowledge giver and into the role of facilitator. The Lesson Study group wrestled with what it looked like to be a facilitator in their classroom. Not only were these teachers most comfortable providing clearly teacher guided instructions, so were their students. How would their students approach the open ended problem if the teacher wasn't prompting them towards a specific approach or answer? If the teacher wasn't steering the mathematical thinking of the students towards the intended learning outcome, what was the teacher doing during the lesson?

These two essential questions provided guidance to the research lesson development and observation criteria as well as to the culminating teacher reflections. By preparing a lesson using an unfamiliar mathematical teaching strategy and adopting a teaching role that was not natural to the mathematical teaching

styles of the Lesson Study group members, the observation of the research lesson was pivotal. Each of the members in the Lesson Study group indicated that by observing and listening to the students' dialogue and use of mathematical conjectures, they were amazed at how much their students understood about the mathematics they were using. The directions provided in the open ended problem were intentionally written so as to not include mathematical terminology or provide problem solving suggestions, yet students were applying their own invented vocabulary and strategies in creative and meaningful ways. The teachers in the Lesson Study group commented how, after watching their students demonstrate their mathematical knowledge in the context of a student directed open ended problem solving lesson, they felt they had a deeper understanding and appreciation of how their students perceive and approach mathematics. Witnessing their students interact with one another in mathematical conversation was so rewarding that the Lesson Study group felt there would be great value in implementing similar mathematical teaching strategies into their own teaching practice.

For a group of teachers who had admitted that they were initially uncomfortable wandering from the prescribed teacher directed teaching methods outlined in their mathematics teaching manuals, this was an incredible shift. These teachers, who were once content to follow the outlined teaching directives in their manuals, were now enthusiastic about taking risks in the planning of their lessons. By creating and experimenting with unfamiliar mathematical teaching practices the group was adopting these practices as their own. Lesson Study provided a concise step by step professional development process through which the teachers

were able to observe how the specific implementation of well planned and researched mathematical teaching practices influenced and enriched the learning of the students in their classrooms.

Feelings of empowerment and ownership over their professional development throughout the researching, planning, and implementation of their research lesson was evident in the post Lesson Study research reflections shared by the participants. Group members shared how they appreciated and valued the voluntary opportunity to independently explore, develop, implement, and observe a math lesson using a strategy that, previously, they would not have attempted. They described how they believed that Lesson Study had allowed them to be professionals in making decisions regarding the changes to their teaching practices. Because they had determined the focus of their professional development, they felt enthusiastic and motivated to explore new mathematical teaching practices. They were willing to attempt new teaching practices and risk possible failure. They felt empowered to have professional conversations that were free from administrative agendas and the critical watch of mathematics consultants. Because each participant had a voice throughout the research, each felt ownership over the research, development, and implementation of the research lesson.

It does, however, need to be mentioned that these feelings of empowerment and ownership over their professional development were not initially shared by the participants. Taking an active role in ones' professional development was clearly not as easy a transition as was expected.

Due to the inexperience and discomfort of teachers in taking the lead roles in their professional development opportunities, the Lesson Study group members were reluctant to initiate and contribute to discussions. There were many moments of long pauses and avoided eye contact during the first Lesson Study meeting as the group members kept looking to me, the researcher, to take on the role of the Lesson Study facilitator. Fortunately as group members were invited to share their stories and their resources, the apprehension in the group quickly subsided.

Each of the steps in the Lesson Study process further enhanced the commitment of the Lesson Study group members to critically reflect upon how their mathematical teaching practices were impacting the learning of their students. For each of the members in this case study, the value of these reflections resonated not only in their contributions to the Lesson Study discussions but also in their empowerment and enthusiasm to continue with the Lesson Study process despite this research concluding.

Lesson Study is an effective Professional Development model

When I read *The Teaching Gap* (Stigler, J.W., & Hiebert, J, 1999) over the summer, I began to really support the need for a professional development model such as Lesson Study. I did, however, question as to whether a Japanese professional development model could be implemented here. When I came to the first Lesson Study session in late September I had expected to see a watered down version of the Japanese model. I had thought that this professional development model

would eventually transform into a top-down approach much like our school wide instructional focus has become. I am thrilled to see that this Lesson Study research allowed Terry, Peggy, and I to dictate the direction, planning, and implementation of our own professional development. I truly believe that this has been the most meaningful professional development I have participated in thus far. (Stacy, personal communication, February 10, 2007)

In their literary works, educational researchers Chokshi and Fernandez (2002, 2004, 2005), Harrison (2004), Rock and Wilson (2005), Stigler and Hiebert (1999), all praised the Japanese Lesson Study process as an effective professional development opportunity that should be implemented by North American mathematics teachers. They spoke of how Lesson Study was a grassroots movement by teachers that allowed them to make informed professional decisions regarding the making of necessary changes to their teaching practices. These changes were identified through the reflective and collaborative observations of the mathematical thinking and learning needs of their students. According to the literature (Stigler and Hiebert, 1999), these changes to mathematical teaching practices not only increased the academic performance of their students; it also instilled in teachers pride in being a professional.

After reading the Lesson Study literature, questions began to formulate. Were these accolades surrounding Lesson Study accurate? Did Lesson study really provide teachers with the opportunity to engage in collaborative professional development dialogue? Were teachers who were using the Lesson Study process

making direct connections between the focus of their professional development and the teaching and learning of their students? Were teachers, free of administrative pressures, empowered to determine the focus of their professional development? Did teachers spend time together researching and experimenting with alternative mathematical teaching practices in their classrooms? Was Lesson Study the effective professional development model educational researchers claimed it to be?

YES! The observations and interview responses of the participants in this case study indicate that Lesson Study was an effective professional development model that allowed them to reflect upon their teaching practices and provided them with insight into the mathematical thinking and understanding of their students. Such insight would prove to be beneficial long after the research had concluded. Due to the immense professional growth that this Lesson Study research provided to its participants, this Lesson Study group continued some fifteen months after the research concluded.

Research Question #2: From the perspective of these Albertan mathematics teachers, what are the benefits and drawbacks of the Lesson Study process?

Throughout the Lesson Study research participants provided feedback, both the benefits and the drawbacks, regarding the use of the Lesson Study process. One of their initial concerns involved the amount of time this research was expected to take. When the teaching staff at Redwood Elementary School were first presented with the opportunity to take part in this research study they were told that the Lesson Study process could take anywhere from three

to six months. Although the overall structure of the Lesson Study process is predetermined, the depth and content of the work involved is dependent upon its participants. Determining a timeline would rely upon a number of factors such as the social dynamics of the participants, the identification of a focus for the research lesson, the development and research for the research lesson focus, the regularity and length of Lesson Study sessions, and the commitment of the members to the study. Due to their obligation to school wide professional development, these teachers identified their time as being precious.

When this research began time was brought to the forefront as a concern when two of the five original participants chose to withdraw citing time related factors. Each stating that the demands on the time and energy of teachers were overwhelming and as a result choices as to where to direct that time and energy needed to be made cautiously. Even during the initial Lesson Study session when the remaining three members tried to work out a meeting schedule there was an intense discussion regarding the use and amount of time needed when meeting together. Ground rules were emerging as one member of the group made it clear that it was important that the meetings start and end on time. Reaching consensus, the group decided that if one member was going to be away they had to let everyone else in the group know the day before so that an alternative day could be established for that week. It was also determined that the meeting would only last for one hour so the group needed to make excellent use of that time and not deviate from the conversation focus. The remainder of the first meeting involved the putting together of a calendar for meeting places and

times. Clearly time was an issue that needed to be decided upon before any further discussions could begin.

Although time related issues did occasionally flair up over the months that the Lesson Study group worked together, it didn't seem to hold as much value as it once had. As the group narrowed their focus on the mathematical learning of their students and the specific teaching strategies they would like to implement, the length of the one hour sessions stretched into two hours with little attention. Not only did the teachers enjoy their collaborative time together they could also see the professional benefits of the work they were doing. Following the completion of their Lesson Study work, the teachers were asked to elaborate upon their initial concerns regarding time as a hindrance. Each of the three made mention that they felt their participation in the Lesson Study research was well worth their time and that they were disappointed to see the study end. The time the teachers spent researching, planning, sharing, and reflecting upon their research lesson and the mathematical learning of their students had made such an impact on their teaching practices that they believed the benefits were worthy of their limited time.

I found the use of the scripted lesson to be a drawback. There was so much pressure to memorize how our questions were worded. Because we were specific as to how we would word our lesson, I felt I was ignoring the confused looks on my students' faces. It was almost as if my audience was Lesson Study group, Peggy and Stacy, and not my students. I really didn't enjoy using such a tight plan that did not allow room for

me to be myself. (Terry, personal communication, February 10, 2007)

Although time was the most dominant drawback, the teachers in this case study identified the use of a scripted lesson and the unfamiliar role of the teacher as facilitator as uncomfortable. Having spent months preparing and researching a lesson only to feel constricted by its strict preparation was seen as a frustration. As lesson planning is part of their professional responsibility, they were all very familiar with the writing and implementation of a lesson plan but what the three teachers in this research were not familiar with was following a scripted lesson. The teacher, who taught the research lesson, commented how she felt following a scripted lesson had voided her of the opportunity to make use of the unexpected and unplanned teachable moments. She and her students had come to expect her to transform their comments and questions into her lessons. She felt that by following the scripted lesson she so focused on the carefully worded script that she neglected making valuable and personal connections with her students.

In addition to the carefully worded questions and directions, the script for this research lesson specifically excluded the teacher as the provider of mathematical knowledge. If students had questions or were looking for confirmation of their answers, the teacher was to respond with specific prompting questions to help students to think on their own. Given that this was not a natural component in the teacher's teaching practices, many students were confused. It was very challenging for the teachers in the Lesson Study group to not intervene when they observed the

perplexed looks on students' faces. Although each of the teachers were amazed by how gradually, over the course of the 45 minute math class, these looks of confusion transformed into enthusiastic inquiry, they still felt like helpless bystanders. Having always been the director of the lesson and the provider of the knowledge, it would take more practice than this one research lesson for these teachers to become comfortable allowing their students to independently explore mathematical problems.

Despite these drawbacks, the participants in this case study were quick to point out the many benefits of the Lesson Study process. The first of these benefits was the opportunity to break away from the isolation of classroom teaching and collaborate with colleagues in meaningful professional conversation. Previous to this Lesson Study these teachers had rarely been provided with the time to listen to the teaching ideas and activities that were being taught in other classrooms. Initially when the teachers began this research project by sharing their specific teaching stories, connections of commonality were developing. These connections strengthened when, throughout the Lesson Study research these three teachers began to share resources, lesson and unit plans, insight on the specific learning needs of students, and collegial support. By confiding in one another their insecurities as mathematics teachers, the group developed a trust that helped to strengthen their commitment to the Lesson Study work. These relationships were evident when, independent of this research, the group began to make preparations for their second Lesson Study.

Lesson Study provided these teachers with a rare opportunity to research and experiment with new and different mathematical

teaching practices. Because the group had developed relationships of trust and support, exposing themselves to the implementation of new practices felt safe. Whereas, previously, the teachers may not have felt comfortable independently introducing a new teaching practice to their students, the research lesson was a collaborative effort therefore all group members had ownership over its implementation. Throughout the weeks that the Lesson Study group researched and planned their lesson, group members openly reflected and shared their feelings of comfort or discomfort with the suggested teaching practices. Hearing the voices of these concerned group members, modifications were made to the research lesson. Using a new teaching strategy, the end result was the creation of a lesson which all members felt comfortable and confident to teach.

Another benefit of doing Lesson Study was the much needed insight in student learning. Watching Terry and Peggy's student solve problems, using a variety of self created methods; and then listening to them demonstrate and articulate their methods to the whole class was incredible. The students were so animated and excited about their ideas, that every hand went up all at once when they were given the opportunity to share. I felt such pride in knowing that our group had created a lesson that resulted in so much enthusiasm and interest in math. By observing the students as they took a simple open ended problem and created, using their own strategies, a method to finding the solution, I am now aware that there are other sources of knowledge in the classroom. It was almost magical watching students, at the end of the lesson; demonstrate how they found their answer. The vocabulary they used, the

explanation of the steps they took, and the obstacles they underwent in finding their answers spoke of how little I knew about the depth to which students understood math. As I am speaking I am thinking about one student in particular who for the past two years has been reluctant to participate in any sort of class discussion or group project. He is a very quiet student who tries very hard to go unnoticed during classroom activities. With Terry providing very little teacher directed guidance, I was very interested to see how he would respond to the activity. I was fascinated watching him quietly get to work independent of the others in his group. He began by measuring the height using pennies and scotch tape. Then he switched to using Lego blocks, converting his Lego units to pennies. I wanted to know more about the mathematical thought processes he was using. Apparently I wasn't the only one who was intrigued by his problem solving strategies as another member of his group asked him to explain how he was solving the problem. Because I had expected the student to shrug off the question, I was stunned to see him explain and then demonstrate to the other student what he was doing. He described how he had first found out that one Lego block is seven pennies tall, so he took the total number of Lego blocks and multiplied by seven to switch the units from Lego to pennies. After all this time, I had assumed, based upon his previous lack of effort, that he was a very low functioning math student. I couldn't have been more wrong. Here was this so called low functioning math student articulating to another student how he was able to solve the problem using algebra, multiplication, and measurement strategies without the use of standard units or measuring tools.

Clearly there was something about the activity planned in this research lesson that encouraged this previously reluctant student to actively participate. I believe that this incredible observation of student understanding would never have happened had we not taking part in this Lesson Study and chosen this activity (Stacy, personal communication, February 10, 2007).

With such careful consideration of student learning helping to guide the Lesson Study group in the lengthy planning and development of the research lesson it was no surprise that another benefit to the Lesson Study process was the valuable insight into the mathematical understanding of students. With most mathematics class sizes averaging around twenty eight students, teachers rarely have the opportunity to direct their attention solely to the mathematical conversations and approaches of individual students. Typically, a teacher's insight into the mathematical understanding of students occurs in the quiet, lonely moments when the students have gone home and the teacher is left to correct their daily work. Having only numerical responses or journal entry responses as evidence of student understanding, the teacher is permitted a very limited glimpse into the mathematical thought processes that students used to obtain an answer. Often times the teacher is left to make assumptions as to whether the student did, or did not, understand a concept. For the teachers in this Lesson Study research, the opportunity to observe their students as they asked questions and verbalized their thinking to one another provided a much deeper insight into student learning than the assessment tools that had previously been relied upon. The insights gathered from both their own observations as well as those from the other

observing members helped teachers to plan for and modify their lessons. By recognizing how individual students learned best and what teaching strategies would be most helpful in allowing them to gain meaningful understanding of the mathematics being taught, the teachers were able to make fewer assumptions about the mathematical understanding of students.

Implications and Recommendations: How this research could contribute to advancing educational research and classroom practice

Once this case study was completed and the data (i.e. reflections of teachers, field notes and audio transcripts from the Lesson Study meetings, and teacher observations) were coded, an analysis was formulated to help determine how Lesson Study, as a professional development opportunity for teachers, could be adopted in Alberta schools. Because of the differences between the Japanese and Alberta school systems, the cultural norms of teachers, and teacher time during the school day, it is expected that the Japanese teacher professional development model of Lesson Study would need to be revised to best fit the needs of Alberta mathematics teachers. The answers to how the Lesson Study process has provided effective professional development for teachers along with teacher reflections regarding the benefits and drawbacks of the process generated from the previous research questions were useful in providing vital insight as to how to make these revisions.

Lesson Study is a collaborative professional development opportunity that can empower teachers to implement and evaluate alternative teaching practices in their classrooms in an

effort to improve student understanding. By allowing mathematics teachers to prepare and observe a research lesson that focuses on the specific learning needs of the students in their classrooms, teachers gain valuable insight into the mathematical understanding of their students. Because the members of the Lesson Study group are both teachers and researchers in the process, the data obtained has direct significance to their teaching practices.

The Lesson Study process provides teachers with an opportunity to collaboratively explore an alternative professional development model. Within every school community there is an abundance of teaching expertise and experience. What is missing, however, is the opportunity for professional sharing. Because Lesson Study is a collaborative process, it eliminates the isolation of teachers, and allows them the opportunity to learn from one another. Together they work to establish a common language around good mathematical teaching practice, thus further strengthening the professional learning community of the school.

In addition to assisting teachers as they increase their awareness of the improvements they can make in their mathematical teaching practices, Lesson Study empowers teachers to engage in professional conversations regarding the teaching and learning in their classrooms. Rather than attend generic professional development workshops presented by subject area specialists, Lesson Study is developed by classroom teachers specifically for the students in their classrooms. By allowing teachers the opportunity to collaborate, research, plan, and implement a research lesson, Lesson Study acknowledges and honors the talents of teachers. Because Lesson Study has a direct connection and

impact on the individual work of teachers, teachers are seen as professionals who are contributing and guiding their own professional development.

The literature tells us that effective professional development occurs when teachers, working collaboratively, feel empowered to determine the focus of their professional development as they look at ways to experiment and modify their teaching practices in alignment with student understanding. Lesson Study has proven that it offers teachers a unique and rewarding professional development opportunity. It allows teachers to develop strong professional collegial relationships and empowers them with ownership, as professionals, over the focus of their professional development all the while offering insight into how changes in their teaching practices can impact the learning of their students. Lesson Study has all the components of effective professional development and yet when introduced to an Alberta school such as Redwood Elementary School it is constrained by issues of time and administrative professional development agendas. This begs further exploration and research surrounding the questions; what do Alberta schools regard as effective professional development? Why, when put into practice, does the Albertan criterion for professional development not align with the research? Is there another explanation, one that the research fails to mention, that would help justify the need for Alberta schools to have professional development so strictly implemented and monitored by school administration?

Arranging time for teachers interested in Lesson Study to collaborate would be of great benefit to those involved as they

look for ways to improve their mathematical teaching practices. As each school has its own specific timetable and commitments, negotiating this time may vary depending upon the culture and community of the school. In the case of Redwood Elementary School, there are a number of options. The first of which is the restructuring of teacher timetables. By organizing teacher preparation time so that members of the Lesson Study group have concurring relief time, these teachers would have time within the school day to meet with one another. Another option would be for administration to look closely at the amount of unassigned time given to teachers. If those teachers involved in Lesson Study were deemed as dedicating their unassigned time to professional development the trade off could be less supervision and committee work. Another option would involve the commitment of administration to teacher professional development. School administrators, by honoring the time constraints on teachers, could chose to allow those teachers who participate in Lesson Study as their professional development focus permission to opt out of the presently mandatory school wide instructional focus work. Doing so would allow for the Lesson Study meetings to occur on days when the rest of the staff was in their instructional focus professional development sessions. This would permit teachers involved in the Lesson Study process the opportunity to streamline their professional development time and efforts into an area that they believed was most important. Although option three would be the most beneficial it is, due to Redwood Schools' commitment to school wide professional development, unlikely to occur.

This case study provides support in stating the claim that Lesson Study is an effective professional development model for

these three teachers as they work to improve their mathematical teaching practices. The teachers in this Lesson Study felt so empowered by their experiences of professional growth and meaningful collaboration that they have chosen to continue their work and through the support of their administration have shared their experiences with their colleagues. In their conversation with other teachers on staff, the group stressed how Lesson Study helped them make the changes in their mathematical teaching practices that have increased the mathematical understanding of their students. As they openly discussed their apprehensions and their successes, they invited other teachers to join them as they started their next Lesson Study. As a result of this enthusiastic presentation, the once reluctant staff at Redwood Elementary School now has two mathematics Lesson Study groups, one in Division one and one in Division Two. Unfortunately due to their School Districts' mandate that every school have a school wide instructional focus, the teachers involved in both of these Lesson Study groups do so on their time and are still expected to attend weekly school wide instructional focus professional development sessions.

For the teachers at Redwood Elementary School to improve their mathematical teaching practices using the Lesson Study process, the presently imposed administrative directed professional development model needs to be re-examined. Lesson Study is most beneficial to teachers in helping them make meaningful changes to their mathematical teaching practices when they are free from administrative agendas. Teachers using the Lesson Study process must be given authority and ownership over the focus of their professional development. They need to feel empowered to explore and experiment with their colleagues the mathematical

teaching practices that they believe would strengthen the mathematical understandings of their students. In schools where teachers are using Lesson Study, administrators should be available to provide support and, if requested, offer consultation. Just as the teachers in this case study had to adjust to a facilitating role, so does the school administration.

As much as teachers feel restricted by administrative directive professional development so do principals. As a school administrative I am sympathetic to the struggles that principals are faced with when implementing professional development initiatives in their schools. Many times the professional needs of the teaching staff are put up against the professional demands of central district administration with principals left in the middle to try and make good decisions regarding the use of money and time in their school. How to encourage school and district administration to allow teachers the opportunity to collectively support one another through a professional development model such as Lesson Study will require a further, more depth, examination of what our school culture sees as the role of administration in teacher professional development. At this point I can only commit to modeling for my colleagues, through my own administrative practice, how I will honor and appreciate the need for teacher directed professional development opportunities. By sharing my experiences with this Lesson Study research I am hopeful that my colleagues will enquire about Lesson Study and a professional conversation could ensue.

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Appendix A

Research Lesson Observation Sheet

Teacher Moves	Students responses Dialogue	Student responses Written work/strategies

Appendix B

Schedule for Lesson Study Group Meetings

Date	Outline of Lesson Study discussion
October 4	Introductions Review of the Lesson Study process Establish meeting times and guidelines
October 11	Share class dynamics and concerns regarding the mathematical understanding of students. Share samples of student work.
October 25	Look over math year plans and share math resources.
November 3	Review year plans and discuss the new math curriculum. Look at a curriculum outcome to focus on the research lesson.
November 8	Continue to narrow the focus on a curricular outcome. Research resources for strategies to implement in the research lesson.
November 22	Research teaching strategies for the selected outcome. Brainstorm the components of the research lesson.
December 6	Plan the research lesson.
December 13	Choose the classrooms for the teaching of the research lesson. Outline the teaching script.
January 10	Script the lesson.
January 24	Finalize the lesson. Create an observation checklist. Review the details of the research lesson. Bring together manipulatives and create student task cards.
January 31	Teach the research lesson. Following the lesson, make revisions, and prepare for reteaching.
February 7	Reteach the research lesson.
February 10	Debrief the Lesson Study process.