

LESSON STUDY'S IMPACTS ON TEACHER PERCEPTION OF
EFFICACY IN TEACHING

by

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ABSTRACT

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Teachers practicing Lesson Study often anecdotally report a positive impact on their teaching practices and as a result students' learning from participation in the Lesson Study process. This study examines the ways in which K-12 teachers perceive that practicing Lesson Study has impacted their teaching. For those that identify an impact, what are the components of Lesson Study that lead to this impact and to what extent is the impact recognizable? In other words, where and in what ways do teachers experience the impacts of Lesson Study as it relates to their teaching and their students' learning?

A mixed-method was used for this study, including a survey and interviews, to examine the scope of Lesson Study and how Lesson Study impacts teachers' perceptions of teaching effectiveness and student learning. The 59 teachers who participated in this study were drawn from K-12 teachers who had practiced Lesson Study in science or mathematics in affiliation with one of four California Science Project sites.

Study findings indicated that teachers found Lesson Study to have the largest impact on their teaching by improving their ability to match instructional strategies

to students' learning needs. Results also suggest that practicing Lesson Study increases teaching confidence and has direct benefits for student learning through the collaboration with colleagues.

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CHAPTER ONE

INTRODUCTION

“Improving something as complex and culturally embedded as teaching requires the efforts of all the players, including students, parents, and politicians. But teachers must be the primary driving force behind change. They are best positioned to understand the problems that students face and to generate possible solutions.”
(Stigler & Hiebert, 1999, p. 135)

I was first introduced to Lesson Study by listening to teachers who had practiced Lesson Study talk about their experiences. The enthusiasm and energy that flooded from them as they talked about their Lesson Study experiences caught my attention and peaked my curiosity. They talked of working with other teachers as a team; trying out new and sometimes daring ideas; thinking deeply about how learning takes place for their students, as well as for themselves; and boldly discussing a reshaping of their own understanding of scientific concepts while learning from one another. The excitement about learning, both for their students, as well as for themselves, permeated the conversations. While it was evident that the Lesson Study experience had a profound impact on these teachers, it was not as obvious exactly what this activity called Lesson Study really was or how one took part in it. For some time Lesson Study seemed to me to float out there as some sort of almost magical force that seemed to transform the professional development realm

from something teachers tried to avoid to something that they chose to spend extra time doing because it helped rejuvenate them and their teaching.

My curiosity drew me to colloquiums to hear teachers talk of their experiences, to trainings to find out more definitively about the Lesson Study process and eventually to being part of a Lesson Study team myself. Later I became a Lesson Study trainer and coach with the Redwood Science Project which led me to my current endeavor as a researcher of Lesson Study. Each step along the way has shed new light on what it means to practice Lesson Study, but it has also led to more questions. What is it about practicing Lesson Study that generates these feelings? Do the sentiments about practicing Lesson Study transfer to teachers' teaching practices? Is there an effect on student learning?

The development of this study has drawn on my own experiences with Lesson Study. Although these experiences are not formally a part of this research, my personal experiences have certainly helped deepen my understanding of the Lesson Study process. To minimize bias in interpreting results, I have excluded Lesson Study Programs that are affiliated with the Redwood Science Project, of which I am Co-Director.

After hearing teachers talk with enthusiasm about their own Lesson Study experiences and seeing the effects of Lesson Study in deepening how teachers think about and examine student learning, I started developing this study. Other studies have been conducted on teacher perceptions of professional development, student achievement, and how Lesson Study is practiced in the United States. Few studies,

however, have examined how teachers practicing Lesson Study perceive the impacts of Lesson Study and how those impacts translate through their teaching to student learning.

The 2007 Trends in International Mathematics and Science Study (TIMSS) developed and implemented by the International Association for the Evaluation of Educational Achievement found that while students from the United States had higher average mathematics and science scores than the TIMSS average across thirty-six countries, the United States students were still falling behind students of several Asian countries (Gonzales et al., 2008).

The Teaching Gap (Stigler & Hiebert, 1999) written in response to the TIMSS 1999 video study described a key difference between the countries compared in the study, in the way they support the continuing development of teachers. In this report, Lesson Study is given as an exemplar of supporting ongoing teacher improvement focused on student learning.

The Current Study

To the extent that teachers report impacts on their teaching and student learning from practicing Lesson Study, this study sought to identify which components of Lesson Study led to those impacts. This research also examines whether the study design provides a valid measure of teacher experience with Lesson Study that can result in valuable insights into the effects of participation.

Chapter Two provides an overview of literature on teacher effectiveness in teaching science and mathematics, the role of teacher perceived self-efficacy,

professional development for teachers, and the use of Lesson Study as a form of professional development. This review of the literature indicated that Lesson Study contains the components generally shown to be effective in teacher professional development, however, questions still remained about how teachers' experiences with Lesson Study affect their classrooms.

Chapter Three details the methods used to conduct this mixed-method study. The rationale behind the development of the survey and the interview are discussed and the study constructs are defined. A description is given about how the study sample was chosen and the method of data collection. The validity and the reliability of the survey instrument are also assessed.

In Chapter Four, the results from the study are presented. The results include the demographics of the study sample, the survey and interview results organized by research question and a description of the context in which participants practice Lesson Study.

Chapter Five provides an analysis of the data collected during this study in addressing the research questions. Connections between the findings of this study and the relevant literature are also discussed. This chapter also includes a discussion of the barriers to practicing Lesson Study that were reported by teachers participating in this study. The chapter concludes by noting challenges and limitations of the data analysis, as well as the significance of key findings.

Chapter Six concludes the thesis. It begins with a concise overview of the study and then summarizes the findings. With particular attention to the collaborative

aspect of Lesson Study and the effect on teacher confidence. Finally, the implications of this study are discussed followed by recommendations for further research.

CHAPTER TWO

LITERATURE REVIEW

“Skilled teachers of science have special understandings and abilities that integrate their knowledge of science content, curriculum, learning, teaching, and students” (National Research Council, 1996, p. 4).

Introduction

In becoming scientifically literate, children and adults alike learn ways of thinking that help them in understanding and navigating the world in which we live (National Research Council, 1996). In order for our children to be taught these critical thinking skills as part of their school curriculum, teachers must have a knowledge base from which to draw and methods to effectively engage students in the learning of science.

This review examines literature surrounding teacher effectiveness in teaching science and mathematics, the role of teacher perceived self-efficacy, professional development for teachers, and the use of Lesson Study as a form of professional development. Although pre-service teachers do receive training in science, it has been found that many teachers do not feel confident in their ability to be effective in teaching science. This review considers both the factors that limit teacher

effectiveness and the elements that enhance teacher effectiveness in teaching science and mathematics. One factor in teaching effectiveness is the type of support and training teachers receive throughout their career. There is a multitude of forms of professional development. A review of the literature on teacher professional development highlighted several common themes that lead to increased effectiveness in teaching. Lesson Study encompasses many of the elements that have been found to aid in the effectiveness of professional development.

Teacher Effectiveness in Teaching Science and Mathematics

“As in other professions, beginning teachers cannot be expected to have mastered all that they will need to know and be able to do when they first begin teaching” (National Research Council, 2001, p. xi). Many studies have found that earning a teaching credential does not ensure that a teacher has the content knowledge necessary for teaching science (National Research Council, 2001). Insufficient content knowledge in science is especially prevalent for those planning to teach kindergarten through eighth grade (National Research Council, 2001). As a result, many elementary school teachers rely strongly on the science textbook, avoid teaching more complex science concepts, and sometimes even minimize the amount of science they teach (Goodnough, 2002; Riggs & Enoch, 1998).

The National Research Council defines teaching effectiveness as “the ability to produce desired changes within the classroom” (National Research Council, 2001, p. 4). One measure of teacher effectiveness is student achievement. The National

Research Council established the Committee on Science and Mathematics Teacher Preparation with the task of identifying issues and making recommendations for the training of teachers in K-12 science and mathematics teaching. In a review of the literature, the Committee on Science and Mathematics Teacher Preparation (2001) found repeatedly that the level of teacher content knowledge and specific training in science and mathematics has a strong correlation with student achievement in science and mathematics. As our expectations of student performance are rising, the standards that need to be met to be an effective teacher are also increasing (Alvarado, 1998; Garmston & Wellman 1999).

There are several limiting factors in teacher effectiveness including insufficient initial training (National Research Council, 2001), a wide breadth of required knowledge (Wheelan & Kesselring, 2005), and a lack of continuing teacher training (National Research Council, 2001). The body of knowledge required to be effective is too great for any one teacher to be successful on their own (Wheelan & Kesselring, 2005). Teacher preparation programs alone cannot provide prospective teachers with enough training to be successful throughout their career, especially in the face of the changing needs of modern classrooms (American Federation of Teachers, 2000). In addition, teaching skills of credential candidates often are not adequately assessed, particularly for future teachers' ability to effectively teach science. For example, exams credential candidates take as part of teacher preparation programs often do not measure their ability to implement inquiry based science

lessons (National Research Council, 2001). Scientific inquiry, which is identified by the National Science Education Standards as being central to learning and teaching science, is defined as “a set of interrelated processes by which scientist and students pose questions about the natural world and investigate phenomena...” (National Research Council, 1996, p. 214). Understanding scientific inquiry is a base from which scientific thought and concepts build, therefore, when pre-service teachers do not learn how to use inquiry in science lessons, their students' science experience is compromised (National Research Council, 1996).

After teachers have been hired, their ability to be effective can be hampered by a lack of ongoing professional development. “Once teachers reach the classroom, they often do not receive the support they need to keep their pedagogical skills and content knowledge current” (Mayer, 2000; National Research Council, 2001). Frequently, schools do not have a procedure in place that facilitates continued professional learning from daily classroom events and teacher practices (Hiebert & Stigler, 2000).

In order for teachers, and in turn schools, to be effective at educating students, schools must be places of learning for teachers as well as students (Desimone, 2009; Hawley & Valli, 1999). There are varying views on what types of learning are most useful for teachers. One perspective is that teachers need to confront a sense of dissonance so they will ask questions and grow in that process of dialogue (Snow-Gerono, 2005). Using the conceptual change model, learners must

first become aware of their own preconceptions and then through a process of testing exposing and confronting their beliefs, learners work towards resolving differences between their original ideas and their findings during experimentation and discussion (Stepans, 1996). As learners build a deeper understanding of the concepts, they can integrate what they are learning in with their prior knowledge to make connections in a larger context (Stepans, 1996).

Many studies have indicated that teachers working together with other teachers is beneficial in increasing teacher effectiveness (Garmston & Wellman, 1999; Goodnough, 2002; Hawley & Valli, 1999; Hiebert & Stigler, 2000; Snow-Gerono, 2005). The interactions that happen between people as they work together create synergies that make the work stronger than the collection of the individual talents (Bandura, 2006). There are several aspects of teacher collaboration that have shown support for teacher effectiveness including: planning lessons together (Hiebert & Stigler, 2000), observing new strategies being modeled (Garmston & Wellman, 1999; Hawley & Valli, 1999), and engaging in peer coaching (Garmston & Wellman, 1999; Hawley & Valli, 1999). When teacher collaboration with a collective shared responsibility for improving the practice of teaching and learning becomes part of the professional identity of teachers, school, teachers and students benefit (Garmston & Wellman, 1999). Garmston and Wellman (1999) report, "In high schools where this sense of collective responsibility was strong, students made larger gains in mathematics, reading, history, and science than in schools where the collective sense

was weaker. These outcomes were especially true for minority students and students from low socioeconomic backgrounds" (p.16).

The Role of Teacher Perceived Self-Efficacy

Many studies have indicated that teachers' own perceptions of science and mathematics and their abilities to teach these subjects have an impact on both what is taught and how the content is taught (Bandura, 1993, Brand & Wilkins, 2007; Tschannen-Moran & Hoy, 2001). Bandura (1994) defines perceived self-efficacy as " people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives" (introduction section, para. I). He goes on to argue that peoples' feelings of self-efficacy impact their behaviors and accomplishments. The level at which an individual is willing to work toward a desired outcome is directly related to their level of confidence that they will be able to attain the desired outcome (Bandura, 2000). Self-efficacy also plays a more subtle but significant role in peoples' performance due to its influence on the types of goals an individual will set, the level of perseverance they will have in working toward those goals, their level of optimism, and even their level of resilience to struggles (Bandura, 2006). In an article on cultivating self-efficacy for personal and organizational effectiveness, Bandura (2000) explains the role of perceived self-efficacy within an organization. He explains that those with higher levels of self-efficacy are more likely to choose more challenging careers and to stay with those careers. Furthermore, teams of professionals with a greater perceived collective

efficacy are more likely to feel satisfaction with the work and be more productive (Bandura, 2000).

Perceived self-efficacy plays a major role in education at three different levels: a student's perceived efficacy in his or her ability to learn, a teacher's perceived efficacy in his or her own knowledge and ability to facilitate learning, and in the collective efficacy in the school as a whole (Bandura, 1993). Moreover, teachers' perceptions of efficacy have been found to influence students' feelings of self-efficacy and to be predictive of student achievement (Bandura, 1993; Riggs & Enochs, 1998; Tschannen-Moran & Hoy, 2001; Tschannen-Moran, A. Hoy & W. Hoy, 1998). Riggs and Enochs (1998) explain that when a teacher does not feel confident in his or her ability to teach a subject, he or she is more likely to dislike teaching the subject, which often results in avoidance of teaching the subject. In contrast, teachers with a greater perception of teaching efficacy are more likely to be more committed and invest more effort in their teaching, have more enthusiasm toward their teaching, be more willing to try new teaching pedagogy to better meet the needs of their students, and are more resilient to challenges (Tschannen-Moran & Hoy, 2001; Tschannen-Moran et al., 1998). Additionally, stress among teachers was reduced with improved teacher efficacy (Tschannen-Moran et al., 1998).

Self-efficacy is based on a perception of competence, not actual performed competence (Tschannen-Moran et al., 1998) however, the strong connections between perceived teacher efficacy, improved teaching performance and increased

student achievement make teaching efficacy an important factor to consider when looking at teacher effectiveness (Bandura, 1993; Riggs & Enochs, 1998; Tschannen-Moran & Hoy, 2001; Tschannen-Moran, A. Hoy & W. Hoy, 1998). Bandura (1994) suggests four ways for creating and strengthening self-efficacy: 1) experiencing success in accomplishing something one has worked hard toward, 2) through vicarious experiences of seeing someone else's sustained effort lead to success, especially if the other person is similar to oneself, 3) social reassurance that one is capable of accomplishing a goal leads to a greater amount of sustained effort and an increased likelihood of success, 4) reducing stress instills a more positive mood and attitude which also leads to a greater sense of self-efficacy. Feelings of efficacy have also been shown to increase in schools where teachers work together to improve student learning, motivation and behavior (Tschannen-Moran et al., 1998).

Professional Development

Professional development is a continuum that starts as part of pre-service teacher education to earn a teaching credential and then continues throughout the career of a teacher (National Research Council, 2001). In looking at the vast array of teacher professional development, questions arise about what constitutes productive professional development. In the California Standards for the Teaching Profession, the California Commission on Teacher Credentialing and the California Department of Education (1997. p. 29) identify six key elements for developing as a professional educator:

- 1) Reflecting on teaching practice and planning professional development
- 2) Establishing professional goals and pursuing opportunities to grow professionally
- 3) Working with communities to improve professional practice
- 4) Working with families to improve professional practice
- 5) Working with colleagues to improve professional practice
- 6) Balancing professional responsibilities and maintaining motivation

Additionally, the National Science Education Standards suggest four areas of focus including: learning science content through inquiry; integrating knowledge about science with knowledge of learning; pedagogy; and students, developing understanding an ability for lifelong learning, and coherent and integrated professional development programs (National Research Council, 1996).

Five common themes that are frequently cited in effective teacher professional development are: 1) a focus on content knowledge with goals based on student outcomes (Alvarado, 1998; Goodnough, 2002; Hawly & Valli, 1999; National Research Council, 2001; Resnick, 2005; van Zee, Lay & Roberts, 2003), 2) training that is based in the classroom on daily activities (Fernandez, 2002; Goodnough, 2002; Hawley & Valli, 1999; Hiebert & Stigler, 2000; Stewart & Brendefur, 2005), 3) active collaboration among teachers (Alvarado, 1998; Goodnough, 2002; Resnick, 2005), 4) a culture of professionalism (Hawley & Valli, 1999; National Research Council, 2001), and 5) training that is sustained over time

(Alvarado, 1998; Goodnough, 2002; Hawley & Valli, 1999; National Research Council, 2001).

The American Educational Research Association suggests that “professional development that is rooted in subject matter and focused on student learning can have a significant impact on student achievement” (2005, p. 2). Many professional development specialists and policymakers agree that in order to increase the knowledge and skills of educators, professional development must focus on “the gaps between goals for student achievement and actual student performance” (Hawley & Valli, 1999, p. 127). There are varying perspectives on the ideal depth and breadth at which to address content as part of a professional development experience. Some suggest that professional development should cover a wide array of topics but in less depth (Goodnough, 2002), while others suggest that fewer topics should be addressed at more depth (National Research Council, 2001). However, most agree, that to become more effective science teachers, teachers need professional development that is focused specifically on increasing their own content knowledge in science (National Research Council, 2001). “High-quality professional development programs that include intellectual growth as well as the upgrading of teachers’ knowledge and skills must be expected and essential features in the careers of all teachers” (National Research Council, 2001, p. 7).

Contrary to what is frequently practiced, many studies have concluded that professional development is more effective when the training is provided in the same

context it will be used (Hawley & Valli, 1999; Hiebert & Stigler, 2000). In the case of the teacher, this would be in the classroom. Just as students learn best when what they are being taught is applicable in a context they know, teachers also learn better when they are learning information they find applicable to their classrooms (Hiebert & Stigler, 2000). It has also been found that when the professional development efforts are seen by teachers as being directly related to their own classroom teaching and assessment, they are more likely to be motivated and engaged in their own learning (Hawley & Valli, 1999).

As discussed in previous sections, teachers also tend to be more motivated and inspired and therefore more effective when they work together in teacher teams. “Studies suggest that the more time teachers spend on professional development, the more significantly they change their practices and that participating in professional learning communities optimizes the time spent on professional development” (Resnick, 2005, pp.2-4). As teachers work together in researching science teaching “they become students of the discipline of teaching” (National Research Council, 1996, p. 5). Collaborative problem solving creates a community in which professional respect empowers teachers (Hawley & Valli, 1999). Professional development is optimized when teachers are treated in a professional manner that takes into account their personal identities as well as the culture and the context in which they work (Hawley & Valli, 1999). The Committee on Science and Mathematics Teacher Preparation (CSMTP) emphasizes the importance of

professional development that is structured in a way that fosters intellectual growth among teachers and leads to an enrichment in their teaching (National Research Council, 2001).

In order for new skills learned in a professional development setting to become part of a teacher's practice, teachers need to have the time and the support to implement these new strategies into their teaching (Goodnough, 2002). New teaching techniques are more likely to become part of a teacher's regular practice when they are introduced as part of a continuous professional development experience including ongoing support rather than as a stand alone workshop (Goodnough, 2002; Hawley & Valli, 1999). The ongoing professional development should be focused on all educators (Alvarado, 1998; National Research Council, 1996) and grounded in classroom practice (National Research Council, 2001). One form of professional development that combines many of the elements discussed above is Lesson Study.

Lesson Study

The report on the Third International Mathematics and Science Study (TIMSS), (now referred to as Trends in International Mathematics and Science Study) brought to light some significant differences in the ways that teaching and teacher training differs between countries (Stigler, & Hiebert, 1999). Japanese students are known for scoring very high on science achievement tests (Gonzales et al, 2004; Yoshida, 1999). The success of Japanese students led educational

researchers to study Japanese classrooms (Yoshida, 1999). One element of teaching that was found to be different in Japan compared to the United States was the method of teacher professional development (Stigler, & Hiebert, 1999; Yoshida, 1999). In Japan, most elementary and middle school teachers participate in *Konaikenshu* which is “a teacher initiated in-service professional development program” that is ongoing and takes place within the school context (Fernandez, 2002; Yoshida, 1999, p. xx).

There are multiple models that can be used for *Konaikenshu*, but Lesson Study (Jugyokenkyu) is among the most popular (Fernandez, 2002; Yoshida, 1999). The name, "Lesson Study" can be misleading because it is not only an individual lesson that is being studied, it is the manner in which teaching and learning are occurring that is being studied (Fernandez, 2002). The practice of Lesson Study contains many elements that are consistent with the research findings of what constitutes effective professional development (Lewis, Perry, & Murata, 2003).

Lesson Study is an ongoing cycle of professional development in which teachers work together in a team to plan a unit of study based on learning goals, teach the lesson while collecting data on student learning (the research lesson), discuss and revise the lesson (debriefing), and re-teach the lesson with the modifications that were made based on the findings from the prior research lesson (Fernandez, 2002; Lewis, 2002; Yoshida, 1999). See Appendix A for a diagram of the Lesson Study process. Determining the goals for student learning sets the focus of the Lesson Study (Chokshi & Fernandez, 2005; Lewis, 2002). Teachers often

choose to focus on a concept that is particularly challenging for students (Lewis, 2002). Goals are set for both academic content knowledge and life long learning (Campbell, 2003; Granger, 2003; Hurd, 2005; Lewis, 2002). Life long learning goals often include social skills or learning skills such as working more cooperatively or applying knowledge learned in one setting to other settings (Campbell, 2003; Lewis, 2002). In determining goals, Lesson Study teams think about where their students are currently and where they would like them to be in the future (Campbell, 2003; Hurd, 2005; Lewis, 2002). This gap between current knowledge and ideal knowledge is used to focus the Lesson Study team throughout the Lesson Study cycle (Campbell, 2003; Fernandez, 2002; Lewis, 2002).

Once the goals have been set, the team starts designing the unit of study and chooses a lesson that will be used for their research lesson (Campbell, 2003; Lewis, 2002). This lesson can be created by the team, or the team can choose to use a lesson they find or have used in the past (Lewis, 2002). During the lesson planning stage of the Lesson Study cycle, teachers carefully examine the lesson in relationship to the learning goals they have set for students (Lewis 2002; Yoshida, 1999). During this time teachers engage in conversations about the content of the lesson as well as expected student responses to the lesson (Lewis 2002; Yoshida, 1999). For each step of the lesson, teachers discuss what they will look for in students' performance during the research lesson (Hurd, 2005; Lewis, 2002). How will the teacher researchers know if their lesson is effective in achieving the goals they set forth?

The answer to this question is used in developing research questions (Fernandez, 2002; Lewis, 2002). For example, if the team wants to see students increase their use of content specific vocabulary, they may develop a list of terms that they would like to hear students use. During the research lesson, the teacher researchers will record how many times each of these terms is used. If teachers are interested in student engagement in the lesson, they may plan to record the number of questions asked by students or the number of students off task.

Before the research lesson, the Lesson Study team clearly identifies what type of evidence of student learning they will collect throughout the lesson (Fernandez, 2002; Lewis, 2002). During the research lesson, one member of the Lesson Study team teaches the lesson in his/her own classroom while the other members of the team observe as teacher researchers collecting data on the elements of the lesson previously determined by the team (Fernandez, 2002; Granger, 2003; Hurd, 2005; Lewis, 2002). Sometimes other teachers or specialists are invited to attend the research lesson as well. Because the lesson was developed together as a team, there is collective ownership of the lesson (Yoshida, 1999). It is the lesson's impact on student learning that is being analyzed, not the teacher who is facilitating the lesson (Perry and Lewis, 2003).

After the lesson is taught, the Lesson Study team comes together for a debriefing (Campbell, 2003; Fernandez, 2002; Granger, 2003; Hurd, 2005; Lewis, 2002). The teacher who taught the lesson is the first to speak about his or her

perception of how the lesson went (Campbell, 2003; Granger, 2003; Hurd, 2005; Lewis, 2002). Each member of the team has an opportunity to comment on the lesson (Hurd, 2005; Lewis, 2002). Following the team members, other invited observers are also given a chance to note observations (Campbell, 2003, Lewis, 2002). The discussion during the debriefing centers around the initial goals set forth by the team (Campbell, 2003, Lewis, 2002). The data collected are compiled and the findings to each of the research questions are discussed (Lewis, 2002). As a part of this process, any work samples collected from the students are reviewed to gain additional insight into how students were processing the information from the lesson (Byrum, Jarrell, & Munoz, 2002). Sometimes research lessons are videotaped, and that videotape is used at this time to review a particularly pivotal moment and to collect additional data that may have been overlooked in the real-time observations (Byrum, et al., 2002; Lewis, 2002).

The review of data during the debriefing leads to the modification of the lesson for re-teaching (Granger, 2003; Lewis 2002). Teachers look for times during the lesson that students do not exhibit the behaviors that were anticipated (Granger, 2003; Lewis 2002). By reflecting on student responses to the research lesson, the Lesson Study team is able to make adjustments to the lesson with the aim of increasing student learning (Hurd, 2005; Lewis, 2002). The cycle thus begins again with planning and will continue on to another research lesson. The second research lesson will be taught by a different member of the team in his or her own classroom

(Lewis, 2002). The cycle of planning, the research lesson, and debriefing can be continued until all members of the Lesson Study team have had an opportunity to teach the lesson in their own classrooms (Lewis, 2002). However, a complete Lesson Study cycle does not always include teaching the lesson in all team members' classrooms (Lewis, 2002). Once a Lesson Study cycle has been completed, the team writes a report summarizing their work (Campbell, 2003; Fernandez, 2002).

Components of lesson study.

Lesson Study includes five major components that are consistent with the recommendations for effective professional development. Lesson Study is a student centered, content based, collaborative, teacher-led, reflective practice (Lewis, 2002). Each of these components of Lesson Study will be discussed in the following sections.

Student centered.

The collaborative planning and the focused attention on student learning in the Lesson Study process moves the central attention from the presenting teacher to the students' thinking (Hurd & Licciardo-Musso, 2005). According to TIMSS, most teachers in the United States tend to focus on students' skills more often than on students and working to understand their thinking (Hiebert & Stigler, 2000). In preparing for the research lesson, teachers work together to anticipate students' thinking and reactions to the lesson (Lewis, 2002). It can be challenging for a teacher in the United States to anticipate students' thinking. The ability to anticipate

students' thinking stems from knowledge gained through previous experience in looking at the process of how students learn (Perry & Lewis, 2003). Without these prior experiences, it cannot be expected that teachers will be able to anticipate how students will process the new material. In Japan, it is more common for teachers' resources to include information on student thinking (Perry & Lewis, 2003). The Japanese teacher's manuals include detailed explanations of how students' thinking is formed around a given concept (Perry & Lewis, 2003). A primary goal of Lesson Study is to develop the "eyes to see students" (Perry & Lewis, 2003, p. 16). Those who support the practice of Lesson Study seek a paradigm shift away from a focus on skill development toward an emphasis on student thinking. For example, showing students how to solve a problem and then assigning many similar problems does not require students to think deeply about the underlying concepts (Hiebert & Stigler, 2000). Whereas, forming the ability to see the thinking processes students use that lead to both academic knowledge and social knowledge is valued because of the belief that both provide insights for predicting and facilitating future learning (Lewis, 2002).

Discussion of mistakes students make and disagreements in points of view are also seen as an opportunity for further learning and an expression of the thinking process (Linn, Lewis, Tsuchida, Butler, & Songer, 2000). By vigilantly watching students interact with a lesson, teachers are able to develop a greater sense of student understanding of the concepts being taught. These close observations allow teachers

to see how students form conceptions so that they can more fully distinguish between the elements that enhance and those that hamper students' success (Hurd & Licciardo-Musso, 2005). Reasoning and problem solving skills as well as overall achievement have been found to be higher when teachers have participated in professional development focused on looking at how students learn (Resnick, 2005, p. 2).

Lesson Study prompts teachers to broaden their view of teaching by specifically connecting their practice to student thinking and learning (J. W. White, personal communication, November 30, 2005). By examining students' interactions with the lessons and artifacts such as student responses produced during the lesson, teachers hone their skills to focus on student learning and thinking (Lewis, 2002). Looking at "...student work often serve[s] as the litmus test for the overall quality of the lesson and its delivery" (Stewart & Brendefur, 2005, p. 6). No amount of reviewing student work samples can substitute for observing students interacting with the lesson as it is being taught (Lewis, 2002). Through observation and reflection, practicing Lesson Study provides an opportunity for authentic assessment of student learning (Byrum, Jarell, & Munoz, 2002).

When teachers closely examine how and when students are learning, the barriers to students' learning also become apparent. Even the ways in which teachers present a lesson or give an assignment can enhance or disrupt students' thinking and learning (Hiebert & Stigler, 2000). The effectiveness of teaching is a continuum with

one end representing low teaching effectiveness associated with instruction that is not closely aligned with goals for student learning and the other end representing highly effective teaching where lesson planning is closely tied to focused goals for student learning (J. W. White, personal communication, November 30, 2005). In Lesson Study teachers strive to move toward more effective teaching by focusing on the connection between the lessons that are presented and goals for student learning (Lewis, 2002). Lesson Study facilitates the identification of both barriers to learning and elements of practice that can be used in the revised lesson to help minimize the effects of these barriers (Byrum et al., 2002).

Lesson Study provides the time and the space for teachers to look at individual student's learning needs from many perspectives and to work as a collective team to plan how those needs can be met (Byrum et al, 2002; Hurd & Licciardo-Musso, 2005; Stewart & Brendefur, 2005). While planning for a research lesson, the needs of individual students and the class as a whole are taken into consideration by linking the learning goals to the lesson, the students, and theory (Hiebert & Stigler, 2000). Lesson Study can be individualized to meet the needs of specific classrooms, students, and teachers because it looks at day-to-day interactions on a classroom level (Hawley & Valli, 1999; Hurd & Licciardo-Musso, 2005). Examining teaching at the classroom level allows for "deep conversations about curriculum, instruction, and student learning" (Stewart & Brendefur, 2005, p. 1).

Content based.

The content-based focus of Lesson Study is both at the student level and the teacher level (Lewis, Perry, Hurd, O'Connell, 2006). Having defined goals for student learning provides a clear aim for teachers and allows both teachers and students to know when expectations have been met (Alvarado, 1998). Knowledge of teaching theories or standards on their own does not ensure teaching practices that effectively implement these strategies (Hiebert & Stigler, 2000). In order for these practices to be reflected in the classroom, teachers need high quality professional development that focuses on subject-matter content (Resnick, 2005). "...until, we get a focused, coherent, and common vision, standards-based education is just another big idea that will wreck itself on the shoals of implementation" (Alvarado, 1998, p. 2).

If we want our students to gain a deeper, more thoughtful understanding of content, teachers must first analyze the curriculum so they can foster interactions with students that will solicit higher levels of thought (Alvarado, 1998). The Lesson Study process guides teachers' thinking in how to convey to students the content of the lesson (Lewis, 2002). As teachers plan the research lesson, they engage in deep consideration of the key concepts that are most important for students to comprehend in order to learn the content being taught (Granger, 2003).

Through practicing Lesson Study, teachers not only think more deeply about student learning, they also assess their own content knowledge (Gorman, 2005;

Granger, 2003; Perry & Lewis, 2003). In working with other teachers, looking carefully at each element of a lesson to anticipate student thinking, teachers confront their own conceptions about specific content and have the chance to increase their knowledge and confidence through their own process of inquiry (Lewis, 2002; Lewis et al., 2006, December; Perry & Lewis, 2003; Stewart & Brendefur, 2005). If the Lesson Study team encounters a concept that they feel is especially important and the knowledge is not within the group, an outside specialist in that particular subject is brought in for consultation (Lewis, 2002; Lewis et al., 2006, December).

Collaborative.

Teachers often report feeling isolated from other professionals in their field (Beatty, 1999; Hawley & Valli, 1999; Snow-Gerono, 2005). Some even report that they are more bothered by being distanced from colleagues than they are by other factors such as unsatisfactory salary and challenging working conditions (Beatty, 1999). Teachers need to be part of a professional community in which they can ask questions and explore concepts (Snow-Gerono, 2005). A Lesson Study team provides the context for teachers to develop a supportive network in which they can work together (Lewis, 2002). Collaboration with other teachers to look at common problems as well as search for solutions produces dialogue and relationships that reduces feelings of isolation and empowers teachers as professionals (Hawley & Valli, 1999). Within these professional learning communities, teachers can build on their own knowledge by sharing uncertainties and supporting each other in inquiry

(Goodnough, 2002; Snow-Gerono, 2005). Sharing this learning process with a trusted group of colleagues helps build the strong bonds of the Lesson Study team that encourage teachers to continue to try new techniques and grow in their profession (Beatty, 1999; Hiebert & Stigler, 2000; Hurd & Licciardo-Musso, 2005; Snow-Gerono, 2005). By working collaboratively with one another, teachers construct their own knowledge and integrate it with that of others to build a more comprehensive knowledge base for the profession (Chokshi & Fernandez, 2005).

The research lesson transforms teaching from a private practice into a public practice (Alvarado, 1998). Together, a team of teacher researchers has many eyes to gather data on students' thinking (Gorman, 2005). They also bring with them a collective expertise of varying perspectives and many years of experience that can be used in planning the lesson, anticipating students' thinking, as well as looking at and interpreting the data from the research lesson (Gorman, 2005). As one teacher reports, "The opportunity to increase our knowledge is directly tied to the lesson study process because we use our collective years of experience and individual areas of strength to analyze and improve teaching and learning" (Hurd & Licciardo-Musso, 2005, p. 395). Carefully examining their work makes teachers more explicit in what they teach and how they teach (Gorman, 2005). In this context, teachers talk frequently and deliberately for the purpose of improving teaching for the means of standards-based student learning (Alvarado, 1998).

Teacher-led.

Often in the United States teachers have been recipients of new ideas, pedagogies, and reforms without taking an active role in shaping the reform of the profession (Chokshi & Fernandez, 2005). When teachers' own voices are not included in shaping their professional development, they often become detached and at times begrudging of what is seen as an imposed professional burden (Hawley & Valli, 1999). Conversely, studies have shown that when teachers perceive that they have greater control over teacher training, student grouping, school and classroom policy, teaching content and technique it results in increased teaching efficacy (Tschannen-Moran et al., 1998). "Lesson study enables teachers to take charge of their own professional development: it puts teachers in the driver's seat and empowers them to direct their own agendas and be their own critics" (Chokshi & Fernandez, 2005 p. 3). When teachers lead their own professional development, they take more ownership over the process and feel more motivated (Beatty, 1999; Byrum et al., 2002; Hawley & Valli, 1999).

Taking the lead in shaping professional development by identifying what needs to be learned and how the learning will take place enhances teachers' commitment to learning and their own feelings of efficacy (Beatty, 1999; Hawley & Valli, 1999). However, taking on these new leadership roles requires teachers to create new images for themselves and learn new skills (Chokshi & Fernandez, 2005). The Lesson Study team provides the support and creates a safe place for teachers to

try out their new teacher-leader roles (Snow-Gerono, 2005). Through their involvement in this process, teachers develop professional identities and become recognized as leaders in their field (Beatty, 1999; Snow-Gerono, 2005). One teacher reported, “Lesson study values us as professionals and allows us to use our collective talents and experiences to increase student achievement through increasing our knowledge as professionals” (Hurd & Licciardo-Musso, 2005, p. 394).

With the majority of a teacher’s professional time being spent in the classroom, teachers are eager to participate in the development of professional training that is centered in the classroom looking at ways to improve daily practice (Alvarado, 1998; Goodnough, 2002; Hawley & Valli, 1999). Because each classroom community is unique, teachers practicing Lesson Study concentrate their analysis of student learning in their own classrooms with their own students (Lewis, 2002). In 1989 teachers were formally recognized as legitimate researchers by the American Educational Research Association’s formation of the Teacher as Researcher Special Interest Group (van Zee, Lay & Roberts, 2003). Conducting research in their own classrooms, as well as in the classrooms of their colleagues, provides teachers with a constant flow of information on the effectiveness of the lesson which is crucial to the process of improvement (Hiebert & Stigler, 2000).

Reflective practice.

Lesson Study promotes reflection on several elements within education (Lewis, Perry, & Murata, 2004): the lesson, the teaching, and student learning

(Hiebert & Stigler, 2000). Lesson Study deliberately slows the practice of teaching to allow for dissection, analysis and reflection (Snow-Gerono, 2005). This process gives teachers the opportunity to carefully study their teaching methods in relation to student learning and make adjustments to enhance their instruction (Hurd & Licciardo-Musso, 2005). As one teacher reported after participating in a research lesson:

A lesson is like a swiftly flowing river; when you're teaching you must make judgments instantly. When you do a research lesson, your colleagues write down your words and the students' words. Your real profile as a teacher is revealed to you for the first time. (Lewis & Tsuchida, 1998, p. 15)

Teachers value the time for reflection and report that it helps to increase their knowledge about teaching and learning (van Zee, Lay & Roberts, 2003). The carefully designed process of collecting data on student learning through observation and reflection reinforces itself because of how directly the findings can be applied back to the classroom (Perry & Lewis, 2003). In Lesson Study, teachers critically observe and analyze the teaching and learning taking place in a classroom in order to develop methods to increase student learning (Hurd & Licciardo-Musso, 2005).

After participating in Lesson Study, teachers often report that they are more reflective in their teaching and feel more confident in their ability to be effective in the classroom (Beatty, 1999; Perry & Lewis, 2003). Just as it is sensible for schools to be student centered, professional development for teachers ought to be teacher

centered (Hawley & Valli, 1999). Teacher centered professional development takes place in the school context, takes into account teachers previous knowledge, and develops reflective capacities (Hawley & Valli, 1999).

Challenges of adopting Lesson Study

Although Lesson Study incorporates many of the elements that are desired for professional development, there are a few challenges associated with translating Japanese developed Lesson Study into the United States professional development system (Campbell, 2003; Chokshi & Fernandez, 2005; Fernandez, 2002; Hiebert & Stigler, 2000; Perry & Lewis, 2003). One often cited problem to practicing Lesson Study is finding the time for teachers to meet together to plan and observe in each other's classrooms (Fernandez, 2002; Granger, 2003; Lewis et al., 2006, December). In the United States many teachers feel a growing pressure to cover the standards rather than deeply explore concepts with students (Perry & Lewis, 2003). Practicing Lesson Study requires a shift in the culture of schools and the way teachers think about teaching, toward the formation of lesson plans that center around student learning (Hiebert & Stigler, 2000) as well as teacher leadership (Chokshi & Fernandez, 2005). Teachers must also be willing to open their classroom and teaching practices to their colleagues which is a cultural shift for many American teachers who are more accustomed to working on their teaching independently (Fernandez, 2002). In a study by Clea Fernandez on how Lesson Study is translating from a common teaching practice in Japan to a model used by United States teachers,

she noted that the largest challenge to American teachers was to move their own thinking beyond just what they are teaching to seeing their teaching practice as an opportunity for their own learning as well (2002). Additionally, there is a concern that as Lesson Study is rapidly spreading in the United States that some teacher teams will begin practicing Lesson Study without sufficient knowledge of the complex layers of the Lesson Study process and as a result will fail to experience the benefits of a true Lesson Study cycle and will consequently dismiss Lesson Study as not being an effective professional development model (Campbell, 2003). Regardless of the challenges, Lesson Study offers a multitude of components that interact together to form an experience that has been reported as beneficial by many Japanese and United States educators.

Conclusion

As one reviews the literature on teacher effectiveness in teaching science and mathematics, the role of teacher perceived self-efficacy, professional development for teachers, and the use of Lesson Study as a form of professional development; it becomes evident that many teachers are not receiving some forms of professional support that would help them to be more effective teachers. A comparison of models of effective science teaching reveals that while at the fourth grade level Japanese and United States students had similar scores in science, but by the eighth grade Japanese students were scoring noticeably higher than United States students (Linn, et al. 2000). Much of Japan's teaching success has been attributed to the use of

Lesson Study as a professional development model (Stigler & Hiebert, 1999; Yoshida, 1999). Due to the success of this professional development model in the Japanese schools, interest in the practice of Lesson Study is growing in the United States (Chokshi & Fernandez, 2005).

Teachers practicing Lesson Study in the United States report that it is a positive experience for them personally and professionally. The majority of the research on Lesson Study in the United States has up to this point focused on transferring the practice from the Japanese culture to the American educational system. The effectiveness of Lesson Study on student achievement has not been thoroughly studied, although several studies have been done on elements of teacher effectiveness. Many of the elements that have been found to be effective in professional development are present in Lesson Study. In an article written by Lewis, Perry and Murata (2006) on how research on Lesson Study should contribute to instructional improvement, they make the argument that drawing connections between observable components of Lesson Study and impacts on instructional improvement are beneficial.

With the multitude of factors that contribute to student success, it is difficult to attribute a teacher's participation in a specific type of professional development to an increase in student achievement (Goodnough, 2002). However, teachers' own feelings about how practicing Lesson Study impacts their teaching can be measured. The impact of a teacher's perception of efficacy on teaching and student learning has

been well documented (Bandura, 1993; Riggs & Enochs, 1998; Tschannen-Moran & Hoy, 2001; Tschannen-Moran, A. Hoy & W. Hoy, 1998). Given this, the purpose of this study is to better understand if practicing Lesson Study has an impact on teachers' perceptions of their own teaching effectiveness and student learning. To the extent teachers report an impact on their teaching and on student learning from practicing Lesson Study, this study will examine what components of Lessons Study lead to these impacts on teaching and learning within the classroom.

CHAPTER THREE

METHODS

This chapter details the methodology used to investigate teachers' perceptions about their experiences practicing Lesson Study and how those experiences have impacted their teaching and student learning. To the extent that teachers reported impacts on teaching and learning based on practicing Lesson Study, this study aimed to identify the components of Lesson Study that were most attributed to those impacts. Through a mixed methods study design making use of a survey including both closed and open-ended questions and follow-up interviews, this study aimed to gain a greater understanding about how teachers were practicing Lesson Study as well as specific and detailed information about teachers' experiences.

The questions for the study were generated based on a review of the relevant literature, observation of Lesson Study teams, informal interviews with Lesson Study practitioners, and questions adapted from other survey instruments. A review of literature helped to identify components of effective professional development, indicators of teaching effectiveness, indicators of student learning and elements involved in the Lesson Study process. Some of the survey items for this study were adapted from other questionnaire and survey instruments developed for evaluating professional development on teachers' feelings of efficacy about their practice (Guskey, 1985; Rubba, 1983; TIMSS Study Center, 1998).

Sample Selection

K-12 teachers from four of California Science Project (CSP) sites who were practicing or had practiced Lesson Study were invited to take the survey. Site directors from the four sites were asked to identify the individuals who had practiced Lesson Study in affiliation with their sites. Purposeful sampling was used in selecting the sample population from a group known to have a specific characteristic, California Science Project teachers who had practiced Lesson Study. Only those who practiced Lesson Study through one of the four selected California Science Project sites were included and results were only collected from the 59 teachers who chose to accept the invitation to participate in the study out of the 152 who were invited to participate. Teachers practicing Lesson Study through the Redwood Science Project, the CSP site which I co-direct, helped inform the development of this study, but were excluded from the final study to help reduce potential researcher bias.

Survey Construct

The survey was designed to gain insight into teachers' experiences with Lesson Study including how different groups were practicing Lesson Study, and the degree to which individuals perceived their experience with Lesson Study had impacted their teaching and affected student learning. To the extent that teachers reported an impact based on their experiences with Lesson Study, the survey also aimed to measure which components of Lesson Study were associated with which type of impacts.

There were three parts of the survey: the initial context questions, the main body of the survey, and demographic questions. The first 13 context questions were to provide information about the context in which the teachers reported their experiences with Lesson Study. The responses to these questions sought to determine if the teacher was currently practicing Lesson Study; the content area of their Lesson Study; the degree of experience the individual had with Lesson Study, including which parts of the Lesson Study cycle they had done, and how many times they had done each part. Teachers were also asked about the reasons they decided to practice Lesson Study and the types of training they had with Lesson Study. Establishing if the teacher was practicing Lesson Study at the time of the survey indicated whether they were likely to be reflecting on an experience they were having at the time or if they were reflecting on an experience they had in the past. Defining the number of times a teacher had done each part of the Lesson Study cycle helped determine their level of experience with Lesson Study. The questions about the types of training teachers received and their motivation for practicing Lesson Study were indicators of the context in which they were practicing Lesson Study. The final question in the context section of the survey asked teachers to rate how important they felt that each of a list of activities was in contributing to their effectiveness as a teacher. The activities listed correspond to the components of Lesson Study (e.g.,student centered, teacher led, collaborative, content focused and reflective), but were not identified as such in this question. The purpose of this question was to gauge the value a teacher

placed on these components in general compared with the experiences they reported having as a part of Lesson Study. These context questions were a combination of multiple-choice, numbering, rating and short response. In the results, all context survey items are identified with a "QC" before the question number.

The main body of the survey contained items designed to gather information about each of the study research questions. The individual survey items were constructed to measure teachers' attitudes about a number of factors associated with each of the study research questions. See Table 1: Survey Construct by Research Question. The Likert scale items are identified in the results with a "QL" before the questions number. The survey included 46 attitudinal items. These survey items were on a seven-point Likert scale which asked teachers to respond to a series of statements with one of the following responses: strongly disagree, disagree, somewhat disagree, unsure, somewhat agree, agree, strongly agree. In addition to finding out if the teachers held certain beliefs, the Likert scale measured the intensity with which a participant held a certain belief. A matrix format survey design with the common stem, "Practicing Lesson Study has prompted me to..." was used for many of the Likert scale items to facilitate ease of responding for the teachers taking the survey.

Of the 46 Likert scale items, 15 of the items were designed to examine teachers' perceptions of how Lesson Study has impacted their teaching effectiveness. Statements associated with the following factors were used to measure these impacts:

assessment of student learning, assessment of student work, matching instructional strategies to students, and teaching confidence. Six of the Likert scale survey items examined the level of student interest and students' expression of thinking in order to better understand how teachers perceive practicing Lesson Study as having impacts on student learning. Twenty-five of the Likert scale questions aimed to identify which components of Lesson Study teachers reported having the strongest impacts on their teaching and student learning. The key components of Lesson Study that were measured for degree of impact were: student centered, teacher led, collaborative, content focused and reflective. Statements about the time involved in practicing Lesson Study were also included since the amount of time needed is often cited as the biggest roadblock to practicing Lesson Study. Three to six questions were asked that were intended to measure each of these elements: teaching effectiveness, student learning, and Lesson Study components. By asking similar questions in different ways, the reliability of the survey results was increased. Reversely worded questions were also added to assess and increase reliability of the survey responses by reducing the response bias and the potential for responses based on what was perceived to be socially desirable. Additionally, this study aimed to test the construct validity of this survey instrument to see if the questions asked map onto the construct intended for this study. See the full survey in Appendix B.

Table 1
Survey Construct by Research Question

1. To what extent do K-12 teachers report practicing Lesson Study has impacted their teaching effectiveness?	2. To what extent do K-12 teachers report practicing Lesson Study has impacted their students' learning?	3. What components of Lesson Study lead to the impacts on teaching and learning reported by teachers?
<p>1A) <u>Assessment of Student Learning</u> -- four items on the ability to assess student learning through observation. [QL 6,18,26, 31]</p> <p>1B) <u>Assessment of Student Work</u> -- three items on assessment for understanding student thinking and revising teaching. [QL 11, 37,46]</p> <p>1C) <u>Matching Instructional Strategies to Students</u> -- four items on increase breadth of instructional strategies to meet diverse learning needs. [QL 19,25,33,39]</p> <p>1D) <u>Teaching Confidence</u> -- four items on teaching confidence and improving teaching. [QL 32,34,35,44]</p>	<p>2A) <u>Student Interest</u> -- three items on student engagement. [QL 5,24,28]</p> <p>2B) <u>Expression of Student Thinking</u> -- three items on students' ability to express ideas and thinking. [QL 13,20,23]</p>	<p>3A) <u>Student Centered</u> -- three items on focusing on students while lesson planning and teaching. [QL 27,30,43]</p> <p>3B) <u>Teacher Led</u> -- three items on teacher influence and feelings of belong to a community. [QL 2,29,40]</p> <p>3C) <u>Collaboration</u> -- five items on teachers perceptions about working with colleagues, amount of interaction and comfort level with interactions. [QL 1,7,12,14,17]</p> <p>3D) <u>Content Focused</u> -- six items on teacher content knowledge, identifying knowledge gaps and presentation of science content. [QL 4,8,9,15,21,45]</p> <p>3E) <u>Reflective</u> -- three items on reflecting on teaching and understanding of content. [QL 36,38,42]</p> <p>3F) <u>Time</u> -- five items on perceptions about the amount of time spent practicing Lesson Study. [QL 3,10,16,22,41]</p>

Following the Likert scale questions, five open-ended questions were posed for teachers to provide a more detailed account of their perspective about the impact of Lesson Study on their teaching and student learning and the evidence of those impacts. Just as gathering evidence of student learning is a hallmark of Lesson Study, asking teachers to describe how they experienced any impacts they were reporting from practicing Lesson Study may provide a much richer description of how the impacts of Lesson Study played out with individual teachers in individual classrooms.

Two additional open-ended questions were asked to better understand a variety of Lesson Study experiences, including those that were not perceived by the teacher to be useful or effective in improving teaching and student learning. The question, *"Do you plan to continue to practice Lesson Study?"* "Why or why not?" was asked to gain information about how teachers connected their experience of practicing Lesson Study with planned future actions. It was anticipated that some teachers may report a positive experience practicing Lesson Study but still may be unsure or not plan to continue practicing Lesson Study. The explanations provided shed light on parts of Lesson Study that are the most useful as well as what parts of Lesson Study could be modified to increase sustainability of the practice. The last question in the main body section of the survey gave teachers the opportunity to add anything else about their Lesson Study experience that had not already been addressed.

The final section of the survey asked demographic questions such as number of years teaching, grades and subjects currently teaching. At the very end of the survey teachers were asked if they would be willing to participate in a follow-up interview. Those who were willing to participate in a follow-up interview, were asked for contact information.

Once a strong draft of the survey was created it was tested using a verbal protocol. I took notes and voice recorded two teachers verbalizing their thoughts as they took the survey. By listening to Lesson Study practitioners verbalize their thoughts while reading and responding to survey questions I was able to identify selected questions that seemed to be unclear or confusing and make modifications to the survey.

Human Subjects Protocol

This study was reviewed by the Humboldt State University Committee for the Protection of Human Subjects in Research and approved (approval # 09-43). To help ensure confidentiality pseudonyms were used throughout the reports on the study results when individuals were identified.

Each participant in this study was required to agree to terms outlined on an informed consent letter which informed potential study participants of the study procedures and potential risks. The informed consent also gave contact information for the researcher, research advisor and chairperson of the humans subjects review committee. See Appendix C for a copy of the full informed consent.

Implementing the Survey

This survey was cross-sectional in that all of the surveys were taken at relatively the same time and included individuals with varying degrees of Lesson Study experience. The window of time open for teachers to take the survey was over the course of one month.

For this study, a self-administered survey was used in order to: 1) investigate feelings and opinions held by the participants that were not easily observable; 2) minimize the impact of the researcher on the responses given by the teacher; 3) gain responses to a number of questions that could be most efficiently answered by seeing the response scale; and 4) obtain a larger number of responses than what could be feasibly obtained by interviews alone (Nardi, 2006).

The survey took most participants 20-30 minutes to complete and was administered in two formats, a paper version and a web-based version. I talked with each of the CSP site directors whose sites were participating in this study to determine which version of the survey (paper, web-based, or a combination) would be best to use with the teachers at their sites. Factors such as response rate, ease of distribution, and efficiency for both teacher participants and site directors were discussed on a site-by-site basis. The paper version was convenient for groups that were meeting together and did not have the facilities to all take a web-based survey at the same time. Requesting a group of teachers to complete the survey when they were already present at a professional development activity resulted in the best

response rate overall as well as increased the likelihood that even those with neutral or negative perceptions about Lesson Study would also complete the survey. The web-based version was more accessible for some participants who were not going to see the CSP site directors. The web-based survey also reduced the time otherwise needed for data entry and limited possible data entry errors. The web-based version of the survey was developed and implemented using a professional membership to SurveyMonkey. A separate collector was set up for each of the participating CSP sites so that each site's data could be looked at separately or pooled together. Three sites chose to use web-based surveys while one site chose to primarily use paper surveys with two participants from that site completing the web-based survey.

In an attempt to increase the response rate, a modified Dillman's Total Design process was used by sending advanced notice about the survey invitation and following-up with multiple reminders to those who had not responded (Dillman, 2000). Of the site directors that recommended using web-based surveys, two supplied the names, emails and school affiliations for their Lesson Study participants while the other one preferred not to give out the contact information and to send out the invitation to take the survey herself. Those site directors that were willing to provide the email contact information were asked to send an email to the teachers at their sites letting them know that they would be receiving an email invitation from me to participate in this study and encouraging them to take the survey. I then sent an email to each individual teacher inviting them to take the survey and providing

them with a link to the web-based version of the survey. Unique links to the survey were provided for each different CSP site, but not for individual teachers within the site. As recommended by Dillman (2000), I personalized each email invitation by sending an individualized email to each teacher addressing them by name. Personalizing the request to participate in surveys has been shown to increase the response rate. Within a week after sending the first email invitation to take the survey, I sent a follow-up email to the full group thanking those who had already completed the survey and letting those who had not yet completed the survey know that there was still time and again provided the link. The next week, I sent another reminder specifically to each teacher who had not responded and again included the link to the web-based survey and also offered the option of a paper survey. The overall survey response rate was 45%.

Survey data collection.

Teachers taking the web-based version of the survey followed the link I sent to them embedded in an email. The first screen that popped-up was the informed consent. In order to continue to the survey, a participant had to give informed consent by entering their name and clicking continue. Once informed consent was given, the following screen contained the bulk of the survey, including the context questions, the main body of the survey, scaled and open-ended questions. At the bottom of the page was the following note: "You are almost finished with the survey. Please click 'next' below to continue to the final page and submit your survey by

clicking 'done' at the bottom of the next page." The final page included the demographic questions and asked participants if they were willing to participate in an interview.

For the CSP site that chose to primarily use paper surveys, I gave the site director copies of the paper version of the informed consent and surveys for each participant. The site director then administered and collected the survey while the group was meeting for other professional development. She then mailed the completed informed consents and surveys back to me. I entered the survey data into the SurveyMonkey system so all data from the study would be in the same format.

Interview

The interviews were a follow-up to the survey and were designed to elicit a deeper understanding from a few individuals' about their experiences with Lesson Study and how they saw those impacts playing out in their own classrooms through their teaching and student learning. Preliminary interviews were conducted with two teachers practicing Lesson Study and a focus group was held with team of an additional five teachers at the beginning of the study to glean additional insights into a variety of teacher valued components of the Lesson Study process as well as to test the basic interview protocol.

The interview protocol was finalized after a preliminary analysis of the survey data and built on common themes emerging across the surveys as well as the information gathered during the preliminary interviews in order to gain more detailed

information about how individual teachers were experiencing Lesson Study. The interviews were based on a semi-structured interview protocol with additional questions to probe for further insights. Follow-up questions were also asked to clarify some statements respondents had given on their surveys. See Appendix D.

Since teachers reported that practicing Lesson Study changed their teaching and/or student learning, the interview segment of this study sought to identify and to gain a deeper insight into how certain Lesson Study components corresponded with the impacts teachers reported. In particular, this aspect of the study aimed to discern any changes teachers experienced in their feelings of efficacy in their teaching.

Interview questions elicited responses about general views on teaching and learning in science as well as teachers specific experiences with Lesson Study.

The first part of the interview asked teachers broad questions about their views on teaching science which included theories on teaching and learning, influences on student learning, and benefits of past professional development. Through these questions, I sought to gain a better understanding about an individual teacher's overall conception of teaching and learning more broadly, beyond just Lesson Study. These insights provided a context through which to view responses to more specific questions regarding experiences practicing Lesson Study.

The second part of the interview focused directly on the individual teacher's experiences practicing Lesson Study. First, I asked teachers to describe their overall Lesson Study experience. From the responses, a teacher's definition of what

constituted their Lesson Study became clearer, as well as some of their feelings about what they experienced. Next, I asked them about the most positive aspects of practicing Lesson Study and if there were any negative aspects of their Lesson Study experience. After gaining information on how the individual experienced Lesson Study, I asked questions which sought to find out if s/he perceived that practicing Lesson Study had impacted her teaching or student learning within her classroom. A question about teaching confidence was also included based on a preliminary analysis of the survey data. At the end of the interview, I asked each teacher to rate the components of the Lesson Study cycle based on the degree to which they felt each component of the Lesson Study cycle was useful. The interviewees were asked for both a numerical rating and an explanation for each rating.

Follow-up interview sample selection and implementation.

Respondents to interview were selected from those who had indicated on the survey that they were willing to participate in an interview. The interviewees were chosen in large part based on their Lesson Study experience and their responses to the open-ended questions on the survey. I chose to interview respondents who had participated in at least one Lesson Study cycle and who provided insightful responses to the open-ended questions. Ten survey respondents were emailed asking if they were available to be interviewed. Appointments were made and four interviews were conducted. Each interview was conducted via phone and was between 15-40 minutes duration depending on how much the Lesson Study

practitioner wanted to share. Permission was given by each interviewee to audio record the conversation. I also took notes of key points during the interview. Immediately following each interview I listened to the recording and transcribed key sections.

Data Analysis

To ensure confidentiality the surveys and interviews were coded using numbers and pseudonyms prior to beginning the analysis of the data. The quantitative data and the qualitative data were first analyzed separately and then considered together. As described above, Likert scale questions sought to find out about teachers' experiences practicing Lesson Study and about their teaching actions prompted by practicing Lesson Study. The open-ended questions asked teachers to report on specific aspects of Lesson Study that significantly impacted their teaching and student learning in their classrooms. Specific areas where the qualitative responses from teachers supported the quantitative analysis and areas where they differed are mentioned in the results and are further discussed in the analysis chapter.

Quantitative Data: Reliability and Validity of the Survey.

Descriptive analysis was run on each item of the context portion of the survey to produce a profile of the respondent pool and to gain a better understanding of the background experiences of the sample population. Descriptive statistics were calculated for all of the quantitative questions in the main body of the survey in order to see the mean and variation of responses given for each question.

The reliability of the Likert scale questions were tested using Cronbach's Alpha Reliability Test and the validity of the survey construct was examined using correlation tables. The Cronbach's Alpha Reliability Test was run using all 46 of the Likert scale survey questions and the responses from the 46 survey participants who responded to all of the Likert scale questions. The result was a Cronbach's alpha level of 0.970. The 13 survey respondents who did not respond to this full set of questions were not included in this part of the data analysis. Based on the corrected item-total correlation scores, questions QL12 and QL35 showed to not be reliable to at least a $r = 0.2$. QL12 had a score of $r = 0.082$ and QL35 a score of $r = 0.111$. After QL 12 and QL 35 were removed, the Likert scale survey items had a Cronbach's alpha level of 0.973.

Correlation tables were used to verify the internal consistency of each of the survey constructs. The correlation table for each of the survey constructs was examined and survey items that did not have a Pearson correlation of at least 0.3 and an alpha level of $p < 0.05$ in relation to more than two other items within the construct were not used in the data analysis. Using this measure items QL12, QL35, QL 45 were removed, noting that QL12 and QL35 were also found to not be reliable. A mean and standard deviation for each of the survey constructs was found by collapsing the means and standard deviations from each of the significant items into an overall mean and a combined standard deviation for the construct. These scores

were then used for comparison between the identified Lesson Study factors.

Additionally, these scores were also looked at in relation to the qualitative data.

Qualitative data.

Qualitative data was gathered both through open-ended questions on the survey and during the interviews. The open-ended responses and interviews provided additional detail which was used to validate, clarify and expand on the analysis of the survey results. Responses to open-ended survey questions were analyzed thematically by survey item based on the research questions of the study. Responses within a survey item were thematically coded and then examined within coding categories. Interview responses were analyzed in two ways. First, the interview responses were examined for areas in which they could provide a deeper understanding of why teachers found specific components of Lesson Study to be especially valuable to their teaching and student learning and how they as teacher saw evidence of the impacts of Lesson Study. Secondly, responses were coded by main themes that were identified by the participants throughout the study.

CHAPTER FOUR

RESULTS

This chapter reports the results of the study including the survey and the interviews. First, an overview is given of the study population demographics, context and general results and then more detailed results are presented in sections corresponding with the research questions. General themes of responses are identified in this chapter and are further discussed in the analysis chapter.

One hundred and fifty-two teachers were invited to take the survey and 69 (45%) responded. Nine began the survey but stopped before getting to the main body of the survey. One answered 11 of the questions on the survey but indicated that he was not familiar with Lesson Study. After removing the nine that were incomplete and the one that was not based on experience with Lesson Study, the results of the survey are derived from 59 respondents. The respondents were drawn from four California Science Project sites as shown in Table 2.

Table 2

Survey Participants by CSP Site

CSP Site	Site A	Site B	Site C	Site D
# of Survey Participants	16	18	19	6

Four of the teachers, one from each of the participating sites, were interviewed after completing a survey. Each of the interviews provided clarification and expanded on the survey responses. See Table 3: *Teachers Interviewed* for additional information about the interviewees. Pseudonyms are used to protect the identity of the participants.

Table 3

Teachers Interviewed

	Marie	Tina	Lana	Becky
Subject	Algebra	Science	Science	Science
Grade Level	Middle	1 st -5 th	5 th	7th & 8th
Experience Teaching	7 years classroom experience	19 years teaching	16 years teaching	16 years teaching
Theory on Teaching and Learning	Students need to engage in what they are doing and really understand rather than just going through the motions.	Students need opportunities to learn and understand concepts through hands-on experience in order to retain the concepts and make meaningful connections especially for abstract concepts.	Hands-on experience, visual and making sure student can teach the concepts back.	Hands-on inquiry based model for teaching using problem based learning.

Lesson Study Experience	On first LS cycle, had debriefed after first teaching. 90 minutes a week during paid time to work with the other mathematics teachers.	On first LS cycle, had taught first research lesson, debriefed and planned second research lesson.	Has been part of 8 LS cycles, with two different teams.	Has been part of 8 LS cycles.
Lesson Study Training	Two PD days, one focused on the achievement gap in mathematics, the second focused specifically on how to do Lesson Study.	Video of Japanese teacher practicing Lesson Study; also training through grant program using Lesson Study.	Attended an introduction to LS workshop and worked with a coach.	Attended an introduction to LS workshop and read the LS handbook.
CSP Site	Site B	Site C	Site D	Site A

Fifty-six respondents answered the question as to how long they had been teaching. They had been teaching between two and 45 years with the most (8%, $n = 5$) having taught eight years. The mean years of teaching including the current year was 14 years. The participants included K-12 classroom teachers as well as a resource specialist, self contained Gifted and Talented Education teacher, a teacher on special assignment, and a retired teacher that had taught middle and high school. Seventy-three percent ($n = 43$) of the participants in this study reported that they were currently teaching middle school (grades 6-8), 59% ($n = 35$) elementary school (grades K-5), and 41% ($n = 24$) high school (grades 9-12). The total percent adds up

to more than 100% because teachers teaching in more than one grade range and were counted more than once. Ninety-two percent ($n = 54$) of the survey participants indicated what subjects they were teaching at the time of the survey. Table 4, Subjects Taught at Time of Survey depicts the subjects respondents reported teaching. The "all subjects" category includes those teaching self-contained elementary school classrooms as well as those at small schools that are teaching all of the core subjects at a middle or high school level. At the middle and high school levels, some respondents indicated a specific discipline within science while others just stated that they were teaching science. The results are shown in the table as reported by the teacher.

Table 4

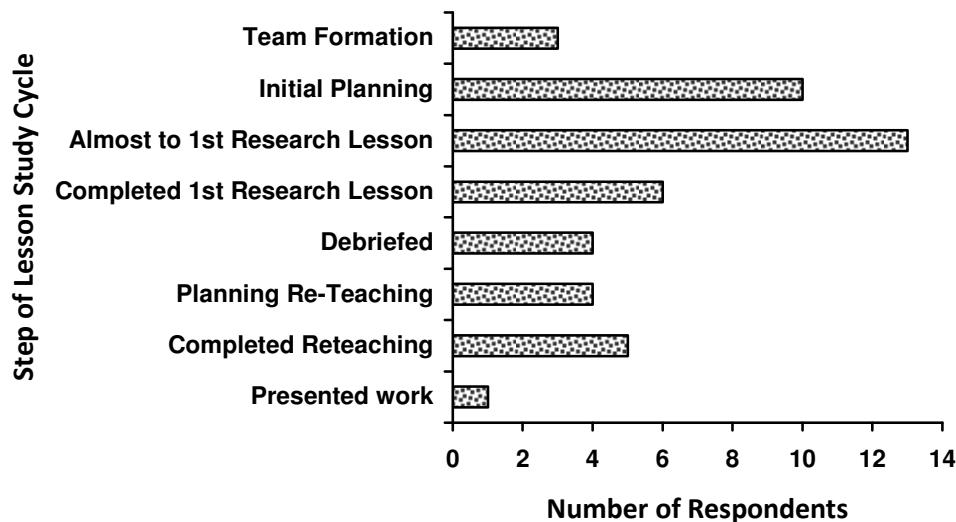
Subjects Taught at Time of Survey

Subject(s) Teaching at Time of Survey	# of Respondents
Science	22
All subjects	16
Math & Science	5
Math	2
Science and Language Arts	2
Math and Language Arts	2

Science and AVID (Advancement Via Individual Determination)	2
Special Education	2
Not currently in the classroom	1

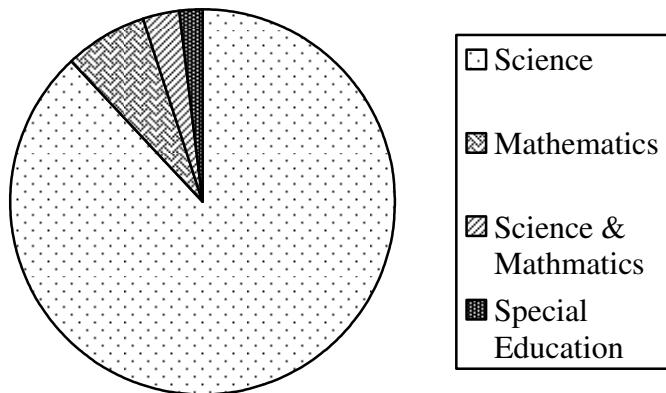
Of the 59 survey respondents, 78% ($n = 46$) were practicing Lesson Study at the time they took the survey. Of those practicing Lesson Study at the time of the survey (28%; $n = 13$) of the respondents, had planned for their first research lesson of the cycle, but had not yet conducted the lesson. An additional 28% ($n = 13$) were in the initial team formation and goal setting stage of their current Lesson Study. Meanwhile, 13% ($n = 6$) had completed the first research lesson of the cycle, 17% ($n = 8$) had debriefed from the first research lesson half of which had moved onto planning for the next research lesson. Eleven percent ($n = 5$) of the respondents had completed at least one re-teaching and one respondent reported they had done a presentation of their work as well. See Figure 1.

Figure 1

Current Stage of Lesson Study Cycle

Of the target population for this study, 88% ($n = 52$) of respondents reported that they had practiced Lesson Study in science. Seven percent ($n = 4$) of respondents practiced Lesson Study in mathematics and two others (3%) reported that they had mostly practiced Lesson Study in combined science and mathematics lessons. For one respondent the focus of the Lesson Study had been special education teacher focusing on language arts and mathematics. See Figure 2.

Figure 2

Subject Areas Mostly Practiced Lesson Study

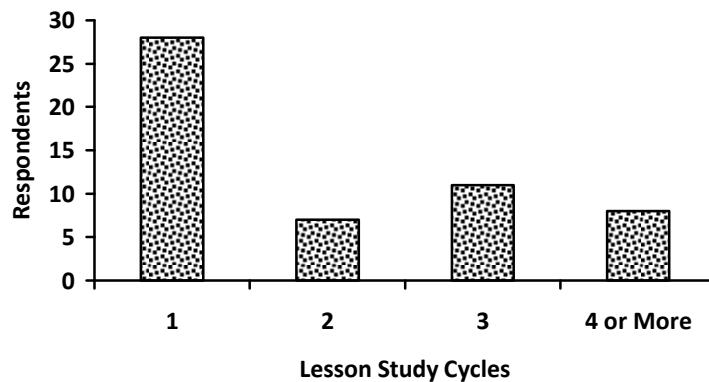
Topics of the current Lesson Studies in which participants were involved included a variety of themes including those focusing on science or mathematics content, academic literacy and teaching pedagogy. See Appendix E for a complete listing of topics. When asked to list the focus topic of all of the Lesson Studies of which they had participated, 41 people responded with 75 topics which included 66 unique topics. Topics included 48 science content specific topics (e.g., weather patterns), 22 pedagogical or general skill topics, many of which also had a science focus, four mathematics based topics, and one history topic.

When asked, *"How many different Lesson Study cycles have you been a part of?"* fifty-four (92%) responded to this question. Of those, the majority 52% ($n = 28$) of the respondents indicated that they had been part of one Lesson Study cycle. Three had been a part of eight Lesson Study cycles. Of those three participating in

eight Lesson Study cycles, two were from Site A and one from Site D. Figure 3 depicts the number of Lesson Study cycle per respondent.

Figure 3

Number of Lesson Study Cycles per Respondent

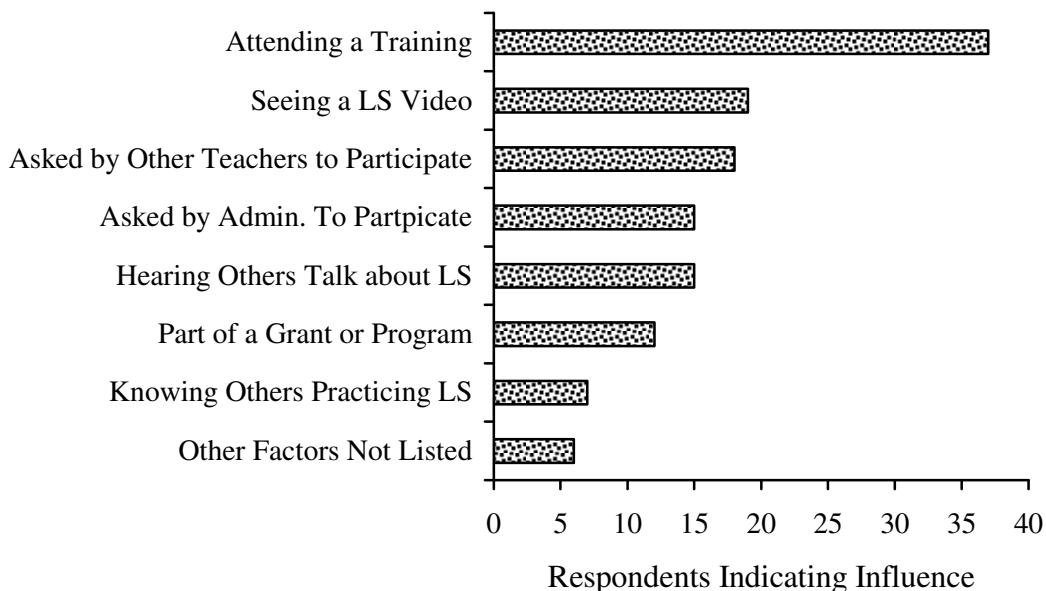


When teachers were asked to identify from a list of seven options what was influential in their decision to practice Lesson Study many respondents identified multiple influences. Sixty-three percent ($n = 37$) indicated that they had been influenced by attending a training. Fifty-eight percent ($n = 34$) were asked by either other teachers or an administrator to participate in Lesson Study, while 25% ($n = 15$) were influenced by hearing others talk about Lesson Study. Additionally, 32% ($n = 19$) indicated that they were influenced by seeing a Lesson Study video and 10% ($n = 5$) marked that they were influenced by reading about Lesson Study in a professional journal. Thirty-one percent ($n = 18$) of the respondents indicated that they were influenced by other factors not listed. Of those 18 respondents, 67% ($n = 12$) noted that they were part of a program or grant that made use of Lesson Study. Other

influences to practice Lesson Study included being curious about it and wanting to learn more, using Lesson Study as a vehicle for team articulation, and seeing it as an opportunity to collaborate. See Figure 4.

Figure 4

Factors Influencing Participation in Lesson Study

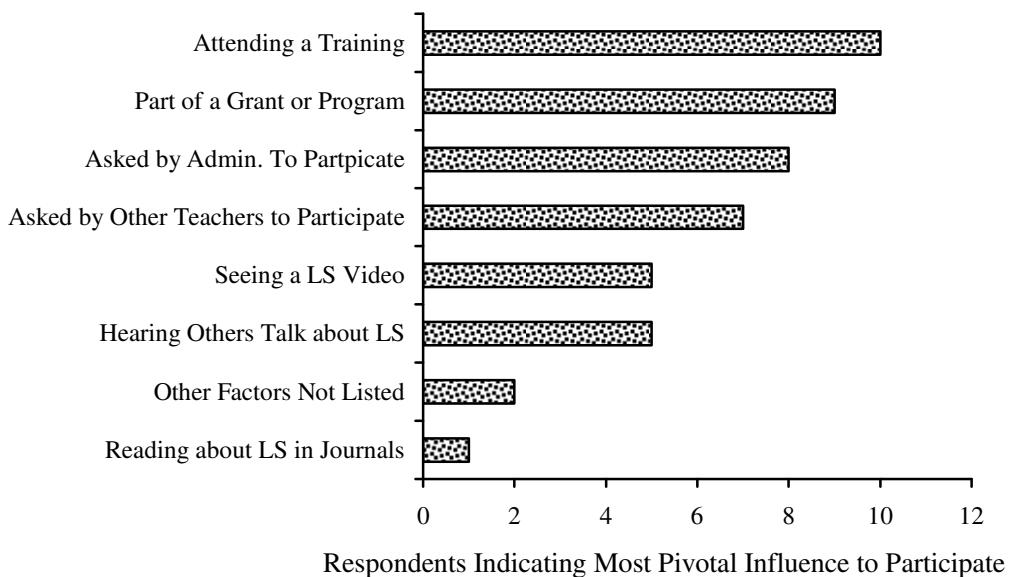


Eighty-three percent ($n = 49$) of the survey respondents answered the question, "*Which of the following was the MOST pivotal in your decision to practice Lesson Study?*" Of those who responded to this question, 31% ($n = 15$) claimed that their decision to practice Lesson Study was most influenced by being asked by other teachers or by an administrator to participate. Another 20% ($n = 10$) specified that attending a training was the most pivotal factor in their decision to practice Lesson Study. Eighteen percent ($n = 9$) of the respondents to this question stated that their

connection to projects endorsing Lesson Study or requirements of a grant was most pivotal in their decision to practice Lesson Study. Hearing others talk about Lesson Study or seeing a Lesson Study video was cited as pivotal by another 10% ($n = 5$) each.

Figure 5

Most Pivotal Factor Influencing Participation in Lesson Study

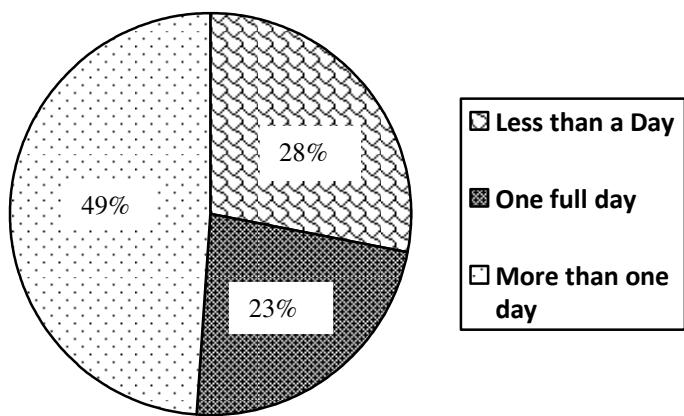


Ninety-five percent ($n = 56$) of survey participants provided information about the type of Lesson Study training in which they had participated. Of those responding, 89% ($n = 50$) had attended an introduction to Lesson Study workshop, 45% ($n = 25$) had worked with a Lesson Study coach, 34% ($n = 19$) had read a Lesson Study handbook, 14% ($n = 8$) reported other training, generally associated with the California Science Project, while 9% ($n = 5$) indicated that they had no training. The duration of their Lesson Study training was reported by 90% ($n = 53$)

of the survey respondents. Of those, 49% ($n = 26$) reported more than a full day of training, 28% ($n = 15$) noted they had less than a day of training, and 23% ($n = 12$) selected that they had one full day of Lesson Study Training. One participant indicated that they had participated in trainings of all three durations. For this analysis, they were counted as having more than one day. See Figure 6.

Figure 6

Duration of Lesson Study Training



In order to better understand the degree to which respondents had practiced Lesson Study, they were asked to indicate the number of times they have done each step of the Lesson Study cycle. Ninety-two percent ($n = 54$) of the survey participants responded. Participation responses are shown in Table 5. The number of times survey participants had taught a research lesson or taught a re-teaching ranged from one to ten times. In their experience with Lesson Study participants reported having gotten at least to the research lesson phase of Lesson Study 104 times,

however they also reported having started a Lesson Study Cycle in which they had not yet got to a research lesson 50 times. The number of times respondents had been part of a team that had completed a report at the end of a Lesson Study cycle ranged from one to six times, with the majority (56%) reporting one time.

Table 5

Lesson Study Cycle Phases (n = 54)

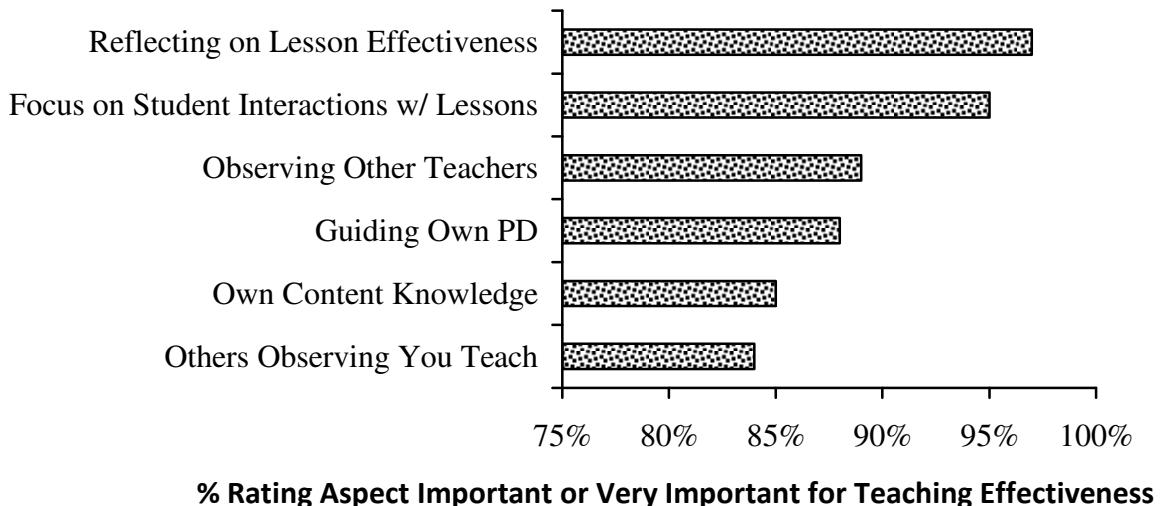
# of Times	Part of Lesson Study Cycle						
	Observed Research Lesson	Taught Research Lesson	Not Yet to Research Lesson	Observed Reteaching	Taught Reteaching	Completed Report	
1	12	23	21	28	31	28	
2	17	14	23	9	9	7	
3	10	6	5	6	3	5	
4	12	3	0	2	2	5	
5	0	0	0	1	1	4	
6	0	0	0	2	1	1	
7	1	1	0	1	0	0	
8	0	0	0	0	0	0	
9	2	2	1	1	1	0	
10	0	1	0	0	1	0	

average	5.4	5	5	5	4.9	5
median	1.5	1.5	0	1.5	1	2.5
sum	54	50	50	50	49	50

The last of the context questions, asked respondents to rate on a four point scale how important each of a list of seven items were in contributing to their effectiveness as a teacher. Most teachers reported that reflecting on a lesson's effectiveness and focusing on student interactions with lessons were important or very important to their own effectiveness as a teacher. Figure 7 Aspects of Teaching Effectiveness, shows all seven items and the rating of importance given by the respondents.

Figure 7

Aspects of Teaching Effectiveness



Summary of Likert Scale Results

The strongest agreement among survey participants was in response to the survey item "*I enjoy the chance to work with my colleagues*" with a mean of 6.31 ($SD = 0.86$) on a seven point scale. Ninety-five percent ($n = 56$) of the respondents agreed with this statement with 85% ($n = 50$) responding "Agree" or "Strongly Agree," 10% ($n = 6$) indicating "Somewhat Agree" and the remaining 5% ($n = 3$) responding "Unsure." There was also strong agreement in response to the statements "*I think it is worthwhile to have other teachers observe in my classroom as part of Lesson Study*" ($M = 5.63$, $SD = 1.19$) and "*Practicing Lesson Study has prompted me to feel more confident about my abilities to continue to improve my teaching*" with a mean of 5.63 ($SD = 0.96$). The statement with the lowest score was "*Practicing Lesson Study has prompted me to feel inadequate as a teacher*" with a mean of 2.02 ($SD = 1.24$).

In examining responses to the Likert scale questions based on the study construct that measures the teaching and learning and components of Lesson Study, teachers report Lesson Study most strongly impacted their teaching effectiveness in terms of matching instructional strategies to students ($M = 5.26$, $SD = 1.19$) and improving their confidence in teaching ($M = 5.25$, $SD = 1.21$). To a lesser degree ($M = 4.83$, $SD = 1.30$) teachers indicate that practicing Lesson Study has impacted their students' learning by increasing student interest in lessons. Practicing Lesson Study had the lowest reported impact on changes in the expression of student

thinking ($M = 4.34$, $SD = 1.26$). The component of Lesson Study teachers report having the largest impact on teaching and learning was the collaborative nature of Lesson Study ($M = 5.47$, $SD = 1.50$). The items relating to the content focus aspect of Lesson Study had the lowest overall mean ($M = 4.17$) and the largest standard deviation (1.57). A full set of results from the Likert Scale questions, grouped by construct are shown in Table 6.

Table 6

Study Construct Means and Standard Deviations (n = 59)

Aspect	Research Question	Scale of 1 (Strongly Disagree) to 7 (Strongly Agree)	
		Mean	Standard Deviation
		Mean	
1. To what extent do K-12 teachers report practicing Lesson Study has impacted their teaching effectiveness?			
1A - Assessment of Student Learning	4.97	1.42	
1B - Assessment of Student Work	4.81	1.41	
1C - Matching Instructional Strategies to Students	5.26	1.19	
1D - Teaching Confidence	5.25	1.21	
2. To what extent do K-12 teachers report practicing Lesson Study has impacted their student's learning?			
2A - Student Interest	4.83	1.30	
2B - Expression of Student Thinking	4.34	1.26	
3. What components of Lesson Study lead to the impacts on teaching and learning reported by teachers?			
3A - Student Centered	5.16	1.38	
3B - Teacher Led	5.24	1.53	
3C - Collaborative	5.47	1.50	
3D - Content Focused	4.71	1.57	
3E - Reflective	4.95	1.45	

Note: based on a 1-7 scale, with seven being most positive n=59

Impact on Teaching Effectiveness

The extent to which K-12 teachers reported that practicing Lesson Study had an impact on their teaching effectiveness was examined in the following ways:

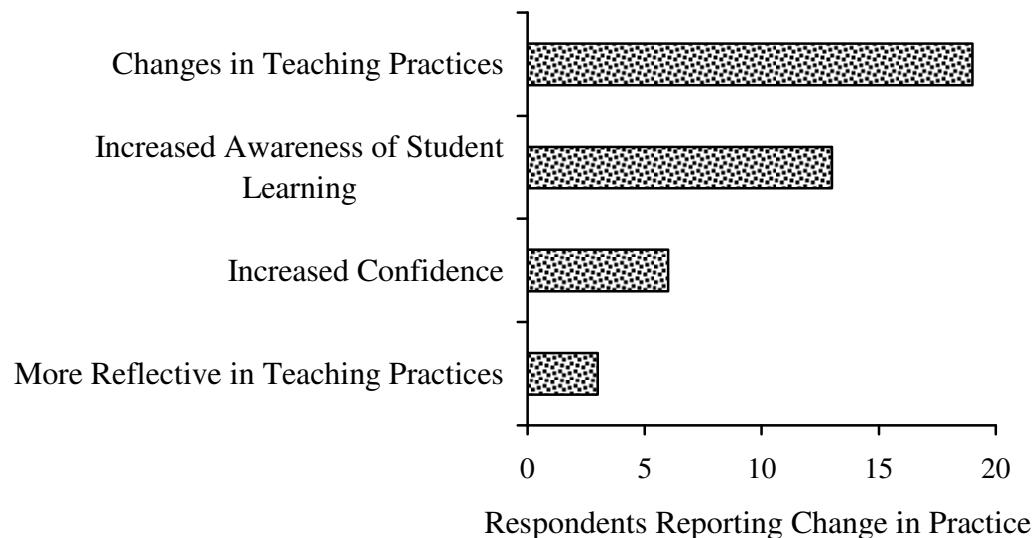
- Open-ended question asking about changes in teaching resulting from practicing Lesson Study
- Likert scale questions focused on assessment of student learning, assessment of student work, matching instructional strategies to students, and teaching confidence
- Interview prompts

Ninety-five percent ($n = 56$) of the survey participants responded to the open-ended survey question "*How has your teaching changed as a result of Lesson Study?*" The major themes revealed by this survey item were: specific mention of changes in the types of teaching practices used by teachers, increased awareness (particularly of student learning), valuable experiences working with colleagues, increased confidence, and becoming more reflective in their practice. Fourteen percent ($n = 8$) reported that practicing Lesson Study has made no or little identifiable changes to their teaching. An additional six teachers stated that they were too new to Lesson Study to be able to see any changes to their teaching yet and two teachers responded that working with others to practice Lesson Study added more work. Only the 40 teachers reporting a change in their teaching as a result of practicing Lesson Study are included in the examination of the themes below. When

an individual teacher reported more than one type of change to their teaching, both are included. Changes to teaching practices used were mentioned by 48% ($n = 19$) of the respondents to this question. Figure 8 depicts the types of changes teachers reported resulting from practicing Lesson Study. Of teachers who reported changes to their teaching practices as a result of practicing Lesson Study, the most ($n = 10$) reported change was to their method of student assessment, followed by facilitating increased hands-on, student directed inquiry type experiences in their classrooms ($n = 8$). As one teacher described, "I think it (Lesson Study) will help me evaluate effectiveness of lessons in different ways."

Figure 8

Teachers Reporting Changes in Teaching Practice Resulting from Lesson Study



Teachers also reported changes in the way they thought about lesson planning. One teacher responded, "I stay more focused on the idea that lessons are

dynamic, and should be revised." Another teacher reported, "It (Lesson Study) makes me think more about each individual student and their learning when I am planning my lessons." Others reported that since practicing Lesson Study, they now think more about incorporating strategies that fit with different learning styles while they are developing lessons.

Thirty-three percent ($n = 13$) of the respondents indicated that practicing Lesson Study has given them an increased awareness of student learning. This increased awareness was indicated by greater attention to levels of student engagement, developing strategies to increase student engagement, anticipating and watching for student responses to the curriculum and being better able to identify student misconceptions. As one teacher responded, "I am paying more attention to how students respond to the lesson." Another teacher noted, "I am more focused on my students' learning and where and how to differentiate my instruction." While yet another responded, "It has helped me to identify student misconceptions and address these issues." Along with an increased awareness of student learning, teachers also reported an increased awareness of their own teaching.

The value of working with colleagues was directly indicated by 18% ($n=7$) of those who reported practicing Lesson Study had changed their teaching in response to the open-ended survey question. The value of teacher collaboration was evidenced through comments on using input from colleagues, implementing ideas from other teachers in one's own classroom, and speaking positively of the opportunity to

collaborate with other teachers. As one teacher explained, "I appreciate the input other colleagues give me, so I feel more confident I am presenting an outstanding lesson to my students."

Increased confidence (15%, $n = 6$) was another result teachers reported from their experiences practicing Lesson Study. In the quantitative portion of this study, 95% of the teachers reported agreement to statements regarding increased teaching confidence through practicing Lesson Study. In the open-ended response, an increase in teaching confidence was attributed to evidence gathered through Lesson Study that confirmed beliefs and practices already held by individual teachers. For example one teacher reported, "I have used hands-on learning for some time now, but this study provides evidence that it is a best practice. It gives me more confidence." Some asserted that as a result of practicing Lesson Study, they are more willing to try new things in their classrooms both in terms of content and classroom management.

Assessment of student work.

Survey participants reported that Lesson Study had the most impact on their ability to assess student work by increasing their ability to create assessments that helped them to revise their teaching and improved their ability to create assessments that helped them better understand student thinking. Table 7 shows the Likert scale survey items used to look at assessment of student work and the corresponding means and standard deviations.

Table 7

Assessment of Student Work: Responses by Survey Item

Survey Question	% Strongly Disagree - Somewhat Disagree	% Somewhat Agree - Strongly Agree	Mean	SD	N
QL 11: Practicing Lesson Study has NOT changed the way I assess students.*	49.2%	27.1%	4.53	1.524	59
QL37: ...create assessments that give me a better understanding of students' thinking.	18.6%	71.2%	4.97	1.402	59
QL 46: ...create assessments that help me revise my teaching.	13.6%	72.9%	4.95	1.265	59

Based on a seven-point scale.

Percentages total less than 100% because those indicating "unsure" are not included.

* This question is a negatively worded question.

Assessment of student learning.

Another measure of teaching effectiveness in this study addressed the assessment of student learning. In terms of the impact of Lesson Study on the ability to assess student learning, the strongest impact indicated by participants was their ability to assess student learning through observation and their ability to carefully study student learning and behavior while teaching. Table 8 shows the responses to the Likert scale survey items used to measure assessment of student learning and the corresponding mean and standard deviation. In the interview with Becky, she

claimed that practicing Lesson Study "made me pay a little more attention to what I was hearing the kids say in the classroom and not just what they were giving me on a piece of paper."

Table 8

Assessment of Student Learning: Responses by Survey Item

Survey Question	Strongly Disagree - Somewhat Disagree	%	Somewhat Agree - Strongly Agree	%	Mean	SD	N
	Survey Question	Strongly Disagree - Somewhat Disagree	%	Somewhat Agree - Strongly Agree			
QL6: My ability to assess student learning through observation has improved.	8.6	77.6	5.26	1.178	58		
QL18: Practicing Lesson Study has had little impact on my ability to assess student learning through observation.*	50.8	25.4	4.54	1.478	59		
QL 26: As a result of practicing Lesson Study, I now more consciously watch students for signs of learning while I'm teaching.	20.3	64.4	4.90	1.528	59		
QL 31: ...carefully study student learning and behavior while I am teaching.	13.6	78.0	5.17	1.392	59		

Based on a seven-point scale

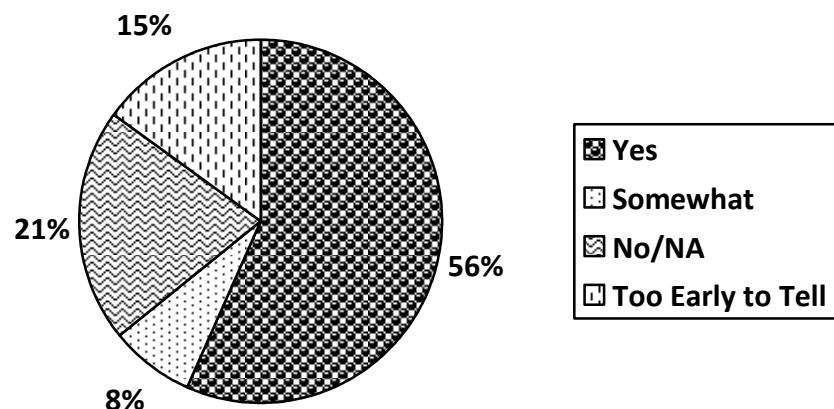
Percentages total less than 100% because those indicating "unsure" are not included.

* This question is a negatively worded question.

In addition to the scaled response items on the survey, an open-ended question was also asked to further explore the role of student assessment. When asked, *"Since practicing Lesson Study, do you assess your students any differently? If so, in what ways?"* 90% ($n = 53$) of the survey participants responded. Of those respondents, 56% ($n = 30$) indicated that since practicing Lesson Study they have changed the way they assess students. Twenty-one percent ($n = 11$) did not report a difference in the way they assess students or indicated that this question was not applicable to their experience. Two respondents that noted that they do not assess their students differently since practicing Lesson Study because they already used multiple data driven forms of assessment, prior to practicing Lesson Study. These two were included as not reporting a difference. An additional 15% ($n = 8$) state that they are too new to Lesson Study to see this type of change or are not currently in a teaching context where this type of change could manifest. Figure 9 illustrates the degree to which teachers report assessing students differently since practicing Lesson Study.

Figure 9

Percentage of Respondents Assessing Students Differently Since Practicing Lesson Study



Of those answering that since practicing Lesson Study they do assess their students differently, three predominate themes emerged: use of a larger variety and different assessments, increased informal assessment, and more careful observation of students for indicators of learning. Of the 56% ($n = 30$) of teachers that indicated that since practicing Lesson Study they have changed the way they assess students, just over half ($n = 16$), classified this change as a use of a larger variety of assessment and/or assessing students differently. As one teacher shared, "Yes, they [students] are assessed differently. Using more ways to assess than just pencil/paper tests. Assessing more frequently in "smaller bites" - one or two concepts at a time

instead of a big test on a unit." Specific responses included, using more open-ended questions, assessing more frequently, using pre/post assessments, aiming for student mastery of specific content, and grading differently. One teacher explained, "Yes, I really look at what they know going into the topic and then comparing it to what they have learned afterwards. I have used more less formal assessments as well." Another teacher asserted, "I have begun to develop more specific criteria for checking for understanding and mastery as well as allowing more creativity in how students can show their understanding of that criteria."

Since practicing Lesson Study, 40% ($n = 12$) of the teachers that reported a difference in the way they assess their students indicated that they now use more informal assessment of student learning. Nearly all ($n = 10$) of these responses specifically described an increased use of hands-on assessment through authentic assessment, performance based assessment, and asking students to demonstrate what they have learned. As one teacher states, "Allowing more time and flexibility for students to show what they know rather than just tell." Another teacher described, "Not relying on written assessments as much, more so on hands-on assessments where students can show me what they know." As one teacher succinctly stated, "I look to authentically assess students using multiple measures."

A third ($n = 10$) of the teachers responding to this item, described the change in the way they assess students since practicing Lesson Study as more carefully observing students for indicators of learning including more closely watching student

reactions while teaching, collecting data, and re-teaching based on assessment before moving onto a new topic. One teacher wrote, "I am becoming more aware of my students behavior and attitude during a lesson. This has helped me to assess my student's understanding of a concept." A second teacher described the change in her assessment of students through observations of students interactions with each other and learning, "More observation of their interactions and exchanges between students. Their comments, "ahhhaas" and questions and the way they react to, accept and consider the questions of their peers." Another teacher discussed her increased awareness of students' thinking process during assessment, "I am more aware of the assessment process that students can come up with and the answers after they go through the process - I am more confident in letting them learn through their process, than me giving them the process - watching others, I get ideas to help my students and evaluate my students."

An increased sense of confidence through practicing Lesson Study was noted in a few of the responses. This confidence building was described as confirming beliefs or practices that were already held. For example, one teacher described, "I have assessed understanding through different means for some time, but this does reassure and reaffirm my method, which is always nice."

Matching instructional strategies to students.

Teaching effectiveness was also measured in this study by teachers' reports on their ability to match instructional strategies to students. Eighty-one percent of the

survey participants indicated that through practicing Lesson Study they had found ways to help their students become better learners. Additionally, 81% of survey participants also agreed that practicing Lesson Study has prompted them to increase the breadth of their instructional strategies. While, 69.5% disagreed with the reversely worded statement, *practicing Lesson Study has had LITTLE impact on my instruction with my students*. Table 9 shows the responses to the scaled survey items used to measure ability to match instructional strategies to students and the corresponding means and standard deviations for each survey item.

Three of the four teachers who were interviewed indicated that practicing Lesson Study has prompted them to be more thoughtful about the strategies they use while teaching and gave specific examples of how practicing Lesson Study has influenced how they match instructional strategies to student learning. Tina reported, "I'm giving it a little more thought, maybe something came up when you were doing an observation [and you think] I should use that with this particular student or just make sure I'm being aware of this or that. It [Lesson Study] has definitely made me more aware throughout my teaching." While, Becky described how she used ideas she learned through Lesson Study to help her students with expository text. Lana explained how Lesson Study made her more adept at helping her students become better learners. She noted that her teaching has changed to a more inquiry-based model rather than just presenting the information to her students. As Lana described, "I present something to my kids that makes them think for a while and then have to

do some exploring first and then bring in the concepts and let them keep going and then let them come up with the answers on their own and then I add in the vocabulary that goes with it."

Table 9

Matching Instructional Strategies to Students: Responses by Survey Item

Survey Question	%	%	Mean	SD	N
	Strongly Disagree - Somewhat Disagree	Agree - Somewhat Agree			
QL 19: By practicing Lesson Study I have found ways to help my students become better learners.	3.4	81.4	5.32	1.025	59
QL 25: Practicing Lesson Study has had LITTLE impact on my instruction with my students.*	69.5	13.6	4.95	1.345	59
QL 33: ...feel more confident about matching my teaching to the needs of my students.	10.3	77.6	5.22	1.170	58
QL 39: ...increase the breadth of my instructional strategies.	10.2	81.4	5.44	1.277	59

Based on a seven-point scale

Percentages total less than 100% because those indicating "unsure" are not included.

* This question is a negatively worded question.

Teaching confidence.

Reports of teaching confidence were also used as a measure of teaching effectiveness in this study. As an indicator of the impact of practicing Lesson Study on teaching confidence, in response to a Likert scale question 91.5% of respondents agreed that practicing Lesson Study had prompted them to feel more confident about their ability to continue to improve their teaching. Table 10 shows the responses to scaled survey items used to measure teaching confidence and the corresponding means and standard deviations.

Table 10

Teaching Confidence: Responses by Survey Item

Survey Question	% Strongly Disagree - Somewhat Disagree		% Somewhat Agree - Strongly Agree		Mean	SD	N
QL 32: ...feel more effective in my teaching.	11.9		78.0		5.22	1.233	59
QL 34: ...feel more confident about my abilities to continue to improve my teaching.		5.1		91.5	5.63	.963	59
QL 44: ...feel more confident about my teaching.	15.8		64.9		4.89	1.305	57

Based on a seven-point scale

Percentages total less than 100% because those indicating "unsure" are not included.

Thirteen percent ($n = 5$) of the participants commented on the open-ended portion of the survey that the confidence building aspect of Lesson Study had the largest impact on their teaching. One teacher summed it up by saying, "It [Lesson Study] reassures me and reaffirms my beliefs in how to teach and assess more effectively." Others also made comments that practicing Lesson Study had added to their teaching confidence in response to one of the other open-ended questions.

During the interviews when participants were asked "*Do you feel practicing Lesson Study has increased your confidence as a teacher? If so, how?*" responses were rather mixed. Tina confirmed, practicing Lesson Study "has reassured me about what I'm doing that I'm on the right track." Becky also indicated that practicing Lesson study has increased her confidence as a teacher and went onto explain how she would like to see more Lesson Study in her district. Meanwhile, Lana's response to the question was, "no, I'm pretty confident in teaching." When asked if practicing Lesson Study had increased her confidence as a teacher, after a pause Marie commented, "I don't think so, maybe a little bit just because I feel I have had one more PD sort of thing I've done and a little more experience." While 91.5% of participants agreed to scaled survey items indicating that practicing Lesson Study increased their teaching confidence, a much smaller number (13%) reported increased teaching confidence as being the most impactful part of Lesson Study.

Impact on Student Learning

In this study, teachers were asked to report on any impacts they noticed on their students' learning that they would attribute to their own experience practicing Lesson Study. In response to the question, "*When you observe your students learning, what if any, evidence can you see of the impacts of Lesson Study?*" a total of 48 teachers (81% of survey respondents) answered. Of those responding, 73% ($n = 35$) reported impacts of Lesson Study on student learning, while 6% ($n = 3$) responded that they had not noticed an impact on student learning. Additionally, 17% ($n = 8$) reported that they were still too early in their Lesson Study process to be able to associate student learning with their practice of Lesson Study. There were also two respondents who indicated that they are no longer in a teaching context to observe these impacts. For the purpose of analyzing this question the two "not applicable" responses and the one "not sure" response are counted as no response. Based on the wording of this question some teachers who have not noticed an impact on their student learning since practicing Lesson Study, may have skipped this question and a "not applicable" response may also mean no observable impact.

Of the respondents who reported observing an impact of Lesson Study on student learning ($n = 35$), by far the most frequently reported effect was increased student engagement at 57% ($n = 20$). Descriptions of increased student engagement included: more student-to-student interaction and communication, increased student enjoyment of the lesson and interest in the content, more student interaction with the

lesson, and students remaining on task. As one teacher commented, "The students are more engaged and excited about learning. They enjoy the atmosphere of more hands on learning." Another teacher observed, "More collaboration among the students, sharing their knowledge and expertise in certain areas with each other." An increased focus on collaboration between students from practicing Lesson Study was also echoed by Tina, one of the teachers interviewed. She described how she works to instill in students the idea that they are all working together to bring each person's strengths together to make one really great team. Tina pointed out that both students and teachers learn from each other. Another teacher reflected, "My students seem more engaged in the process of learning, questioning, and listening to other's ideas."

An increased level of students' expression of thinking was noted as evidence of impacts of Lesson Study on student learning by 29% ($n = 10$) of those who reported observing impacts. Student expressions of thinking were described as, increased participation in class activities and discussion, students more open with sharing ideas and goals, and student self-evaluation. One teacher described how this was seen through, "The exchange of knowledge during the lesson study. The lower level helping even the higher level students." A second teacher reported, "Lesson Study allows the students to work in interactive groups more, which expands their thinking and communication skills." During her interview, Becky shared that "hearing the kids' conversations really is a way to look at what they are learning." During another interview, Lana explained how Lesson Study has led her

to using more inquiry and she has noticed students wanting to figure out why something happened. As a result, she reports that students are doing more of the thinking rather than her just telling them what is happening.

A third piece of evidence of Lesson Study's impacts on student learning reported by teachers, was improved student comprehension. Of the teachers reporting impacts of Lesson Study on student learning, 20% ($n = 7$) noticed this impact through improved student comprehension including more correct answers on classroom assessments and a heightened use of academic content language. "Students tie labs in to what they learn in other class time better," one teacher reports. Another teacher describes seeing improved student comprehension through "more verbal communication of ideas and content knowledge or academic vocabulary being used." Yet another teacher sees evidence of the impacts of Lesson Study on student comprehension in the students' "Ability to respond appropriately, more student to student communication more correct answers on class work." Furthermore, one teacher claimed, "They [students] are more confident in their ability to learn and understand."

In addition, 23% ($n = 8$) of the teachers gave responses indicating that they have become better observers of student learning. For example, one teacher commented, "They engage, and I'm ready to recognize either signs of learning or signs of confusion."

Student interest and expression of thinking.

Along with the open-ended survey question and the interview prompts, the impact of teachers practicing Lesson Study on student learning was also examined through two sets of Likert scale questions, one designed to elicit responses about student interest in lessons and the other about expression of student thinking.

Overall, survey respondents reported stronger levels of agreement that practicing Lesson Study had impacted student interest in lessons compared to students' expression of thinking. However, the impact on student learning in terms of student interest ($M = 4.83$, $SD = 1.30$) and expression of student thinking ($M = 4.34$, $SD = 1.26$) were not as strong as the measures of impact on teaching effectiveness (with the exception of the teachers ability to assess student work ($M = 4.81$, $SD = 1.41$)).

Of the survey items designed to look at student interest, the statement most widely agreed with was "*Lessons developed as part of Lesson Study show increased student engagement*" with 67.2% of respondents agreeing. Table 11 shows the scaled items used to look at student interest and the corresponding means and standard deviations.

Table 11

Student Interest: Responses by Survey Item

Survey Question	%	%	Mean	SD	N
	Strongly Disagree - Somewhat Disagree	Agree - Somewhat Agree Strongly Agree			
QL 5: My practice of Lesson Study has NOT changed my students' engagement in lessons.*	44.8	19.0	4.55	1.441	58
QL 24: Lessons developed as part of Lesson Study show increased student engagement.	8.6	67.2	5.00	1.155	58
QL 28: My students have an increased interest in the in lessons I developed using Lesson Study.	10.3	62.1	4.93	1.255	58

Based on a seven-point scale

Percentages total less than 100% because those indicating "unsure" are not included.

* This question is a negatively worded question.

Of the statements about Lesson Study the item related to the expression of student thinking had the weakest levels of agreement among the survey constructs with only 40.7% to 44.8% agreeing with the positively worded statements related to this construct and the majority of participants responding as "unsure" to each of the

component statements in this construct. Table 12 lists each of the items used for this construct and the corresponding means and standard deviations.

Table 12

Student Thinking: Responses by Survey Item

Survey Question	%	%	Mean	SD	N
	Strongly Disagree - Somewhat Disagree	Agree - Somewhat Agree			
QL 13: As a result of my participation in Lesson Study, my students seem better able to respond to each other's ideas during class discussions.	19.0	44.8	4.31	1.301	58
QL 20: Lesson Study has had little impact on my students' ability to respond to each other's ideas during class discussions.*	42.4	23.7	4.37	1.338	59
QL 23: Since I've been practicing Lesson Study, my students are better able to articulate their thinking.	18.6	40.7	4.34	1.154	59

Based on a seven-point scale

Percentages total less than 100% because those indicating "unsure" are not included.

* This question is a negatively worded question.

Components of Lesson Study

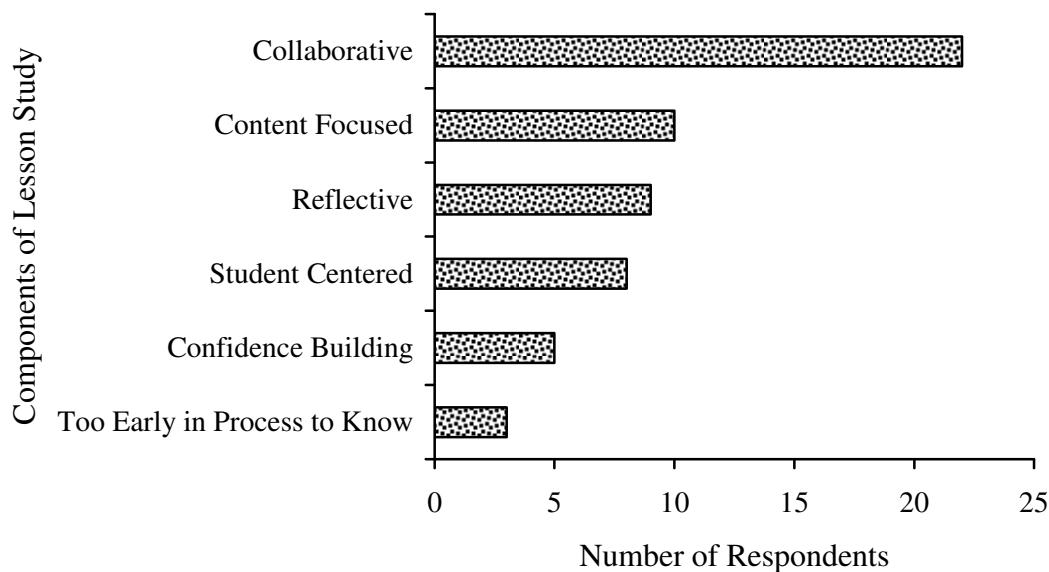
This section examines the extent to which respondents report each component of Lesson Study having an impact on their teaching and/or student learning. The main components of Lesson Study identified in this study are collaboration, content focus, reflective practice, student centered, and teacher led. The reported impacts from each component of Lesson Study are drawn from survey responses to both open-ended and Likert scale questions as well as responses to interview questions.

When asked, "*If you have noticed an impact on your teaching, what about Lesson Study do you think most contributed to the impact?*" eighty-three percent ($n = 49$) of the survey participants responded and of those impacts were discussed by 80% ($n = 39$). Three respondents claimed that they were too early in their Lesson Study process to be able to tell which components of Lesson Study will be most impactful in their teaching. Two respondents had negative responses. One reported "gave me more work to do." While the other indicated, "It [my teaching] really has not changed as a result of Lesson Study--I am not teaching the same curriculum now that I have in the past. Additionally, I attended a Modeling workshop that overhauled how I now teach. That workshop has had a greater and more noticeable effect on my teaching. I am not sure how much may also be due to lesson study." In addition, five participants responded that this survey item was not applicable. Of those who reported impacts on teaching effectiveness from practicing Lesson Study, the

collaborative component of Lesson Study followed by the content focus were reported most frequently as having the greatest impacts. Figure 10 shows the components of Lesson Study that were reported to the greatest impacts on teaching effectiveness. The results for each of these components are further discussed later in this chapter.

Figure 10

Components of Lesson Study Reported as Most Impacting Teaching

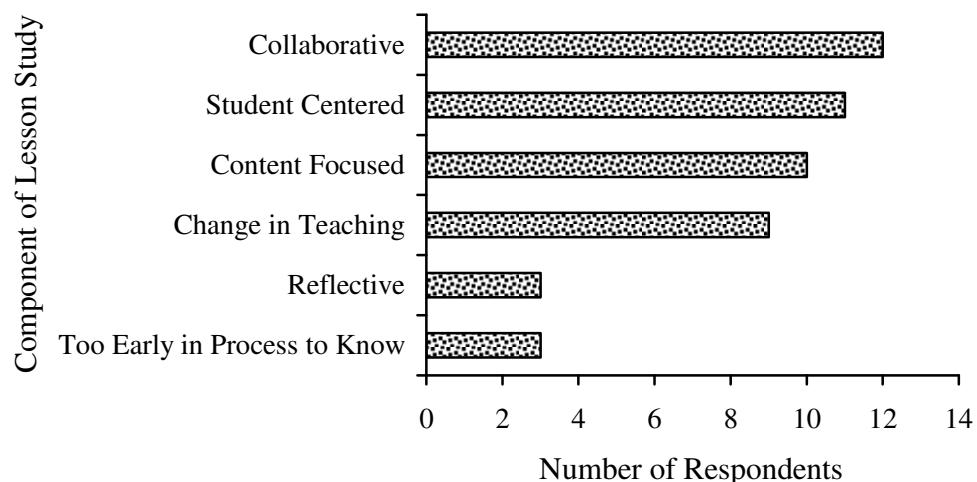


Of the 59 total survey respondents, 78% ($n = 46$) responded to the question, "*If you have noticed an impact on student learning, what about Lesson Study do you think most contributed to the impact?*" Of those who responded, three indicated that they were too early in their Lesson Study process to identify impacts on student

learning, six responded with not applicable, and one with "not sure." These ten respondents are not included in the calculations of the following components of Lesson Study that were seen as most impactful on student learning. Of those who did report Lesson Study as having an impact on student learning, the components of Lesson Study most frequently reported to have the greatest impact were collaborative and student centered components. Figure 11 shows each component of Lesson Study in the order of most impactful to least impactful on student learning based on the open-ended survey responses from study participants. Each component of Lesson Study is discussed in greater detail later in this chapter.

Figure 11

Components of Lesson Study Reported as Most Impacting Student Learning



Of those who reported that Lesson Study had impacted their teaching or student learning, the responses were coded in relation to the main components of

Lesson Study identified in this study: collaborative, content focused, reflective, student centered, and teacher led. All of these components of Lesson Study were directly addressed in teacher responses both as impacts on their teaching as well as student learning except for “teacher led.” A code was added for confidence building since that is an additional theme that has emerged from the responses throughout this study.

Collaborative.

The collaborative aspects of Lesson Study were by far the most frequently identified both through the survey questions as well as in the interviews as the component of Lesson Study that most contributed to having an impact on teachers' teaching and student learning. In all, 56% ($n = 22$) of the respondents to the open-ended survey question about the impact of Lesson Study on their teaching identified collaboration as the part of Lesson Study that has been most impactful. Collaborative aspects of Lesson Study that were specifically mentioned as impacting teaching included, enjoyment of working with colleagues, increased interaction with colleagues, increased comfort level with asking colleagues questions and observing each other's teaching, and collaboration as a helpful tool for furthering one's own thinking especially through talking with others.

Several respondents mentioned collaboration as a means to one of the other aspects of Lesson Study. For example, one teacher responded, "I think collaboration has been helpful, made me more willing to ask questions about things I am unsure of.

I definitely think that when you have more minds working together, ideas and creativity flow. Reflecting on the lessons helps us to find better ways to do things that are more effective for the students." During the interview, Becky described the most positive aspect of practicing Lesson Study in the following way, "the team building with my colleagues and not feeling like making a mistake was a bad thing. Learning from things that don't work, if it doesn't work let's not do it anymore, that was a valuable lesson."

Collaboration was also identified as a key component of Lesson Study contributing to student learning by a third ($n = 12$) of the respondents who, in response to open-ended survey questions, suggested that they had noticed an impact from Lesson Study on student learning. Collaboration was discussed in three ways: in terms of teacher collaboration; collaboration within the classroom among students; and between students and the teacher. The reports of teacher collaboration on open-ended survey questions mirrored responses to scaled questions earlier in the survey with a focus on the power of working together, watching each other teach, and sharing ideas. As one survey respondent reported, "We as teachers are working more together and solving common problems with 2, or 3, or 4 brains instead of one." Another teacher describes, "The ability to actually SEE other strategies and methodologies in use impacts the effectiveness of my teaching/instruction." While, another explains how she has experienced the impacts of practicing Lesson Study, in the classroom with her students, "I think it is the fact that they are all interacting and

I am too. They have input when a question comes up that I cannot immediately answer we search for the answer as a group. I don't try to "answer" all their questions." Collaboration between teachers resulting in changes to classroom interactions is affirmed by this teacher's response to the impacts of Lesson Study that she has seen in her classroom, "My own realization and belief in the power of collaboration among my students, which developed from my own collaboration with other teachers. Three people in the room make one genius!"

Additionally, of the five components of Lesson Study examined in this study, the strongest agreement among the Likert scale responses was also the collaborative aspect of Lesson Study. Of the respondents, 94.9% ($M = 6.31$, $SD = 0.86$) indicated that they agreed with the statement, "*I enjoyed the chance to work with my colleagues.*" No one disagreed and three stated that they were unsure. During her interview Tina remarked, "I've learned a lot from the people on my team, just from listening to them talk and sharing some of the things from their experience, that's really valuable." Marie noted that the collaboration time with the other teachers was useful for developing common goals. Additionally, 91.5% ($M = 5.69$, $SD = 1.19$) of survey participants reported agreement with the statement, "*I think it is worthwhile to have other teachers observe in my classroom as part of Lesson Study.*" During the interview Becky explained, that it is useful having colleagues watching you implement something new in your classroom because when you're doing the teaching you really can't see everything the kids are doing and how they are responding and

what types of misconceptions they have. Table 13 shows the percentage of agreement with each of the items used to look at the collaboration aspect of Lesson Study and the corresponding means and standard deviations.

Table 13
Collaborative: Responses by Survey Item

Survey Question	%	%	Mean	SD	N
	Strongly Disagree - Somewhat Disagree	Agree - Somewhat Agree			
QL 1: I enjoyed the chance to work with my colleagues.	0.0	94.9	6.31	.856	59
QL 7: I interact with my colleagues more often now than before I started practicing Lesson Study even outside of the Lesson Study meetings.	17.2	72.4	5.05	1.561	58
QL 14: Practicing Lesson Study has made me feel less isolated from other teachers.	24.1	70.7	4.81	1.772	58
QL 17: I think it is worthwhile to have other teachers observe in my classroom as part of Lesson Study.	3.4	91.5	5.69	1.193	59

Based on a seven-point scale.

Percentages total less than 100% because those indicating "unsure" are not included.

During the interviews, the teachers also emphasized the importance of being able to watch their colleagues teaching. As Lana stated, "I think it is really very useful to watch other colleagues teach and the way they do things and then come back together and make it even better." She later continued on to explain, "working with my colleagues, being able to see someone else teaching is huge. Spending all that time on preparing the lesson and then having all of those adults there with you, you can really do a bigger, bolder lesson." Tina asserted that for her the most positive aspect of practicing Lesson Study was the collaboration, "seeing different ways of teaching the same content and to get new ideas as others suggest, "try this, or try that."

All four teachers interviewed talked positively about the opportunity to collaborate with colleagues, however, one interviewee, Marie also discussed some ways in which practicing Lesson Study had some adverse impacts on the collaboration between their team of teachers. She explained how Lesson Study set up a situation for tensions when one team member was not able to do her share of the work as part of the team and let the rest of the team down when they were counting on her.

Content focused.

Just over a quarter ($n = 10$) of the participants who noted an impact from Lesson Study on their teaching in the open-ended response, indicated the content focus of Lesson Study had the largest impact on their teaching. Of those ten, four

reported expanding their curriculum, by sharing resources, integrating language arts into science, or developing new lessons. Others reported working to improve their own understanding of the content. During her interview Lana explained, "when you are involved in something like [Lesson Study] you just become more involved and attuned to what your curriculum standards are." While for others the key part of the content focus centered on the presentation of the lessons. As one teacher explained, "Lesson Study gave us a chance to try new things in an environment where we had a lot of support to figure out how to make new things actually work and keep them manageable. Therefore, we were able to figure out together how to make these new strategies work in each of our own classrooms on a daily basis."

In response to an open-ended survey question about what aspects of Lesson Study had the greatest impacts on student learning, the content focus of Lesson Study was reported by 28% ($n = 10$). The content focused aspect of Lesson Study was most often exemplified through discussion of the well planned lessons. As one teacher asserted, "A well thought out lesson that addresses possible misconceptions has created the greatest impact." Others mentioned the focused, goal oriented, and more thoughtfully designed aspects of the lesson planning process they engaged in as a part of Lesson Study. Another teacher commented on the value of having a set of solidly planned labs that can be reused.

Although the content focus of Lesson Study was mentioned as most impactful on both teaching and student learning by over a quarter of the participants

in the open-ended survey responses, it was not emphasized as strongly in the interviews and was not identified as strongly in response to the Likert scale items as the other components of Lesson Study. At the end of the interview when Becky was asked to comment on each component of Lesson Study she did assert, the importance of teacher content knowledge by explaining that the teacher must know a concept in depth in order to be able to have students understand the concept with depth. In response to the Likert scale items, 62.7% ($M = 4.95$, $SD = 1.58$) of the respondents, indicated that *practicing Lesson Study has deepened their science/mathematics content knowledge*. While 62.1% ($M = 4.57$, $SD = 1.68$) indicated that *during the Lesson Study process I found that I had gaps in my content knowledge*. Table 14 lists the scaled survey items used to measure the content focused component of Lesson study and the corresponding means and standard deviations.

Table 14

Content Focused: Responses by Survey Item

Survey Question	% Strongly Disagree - Somewhat Disagree		% Somewhat Agree - Strongly Agree		Mean	SD	N
	Strongly Disagree	Somewhat Disagree	Strongly Agree	Somewhat Agree			
QL 4: Practicing Lesson Study has deepened my science/mathematics content knowledge.	16.9	62.7	4.95	1.580	59		

QL 8: During the Lesson Study process I found that I had gaps in my content knowledge.	27.6	62.1	4.57	1.677	58
QL 9: As a result of the Lesson Study process, I am now more comfortable admitting gaps in my content knowledge to my Lesson Study team.	25.4	55.9	4.49	1.685	59
QL 15: Practicing Lesson Study has had little impact on my content knowledge.*	57.9	24.6	4.51	1.571	57
QL 21: Practicing Lesson Study has had LITTLE impact on how I present science/mathematics content.*	69.5	15.3	5.02	1.333	59

Based on a seven-point scale.

Percentages total less than 100% because those indicating "unsure" are not included.

* This question is a negatively worded question.

Reflective.

Twenty-three percent ($n = 9$) of the participants responding to “*If you have noticed an impact on your teaching, what about Lesson Study do you think most contributed to the impact?*” reported the reflective practice of Lesson Study as

having the largest impact on their teaching. Some teachers reported individual reflection while others reported the reflection as a team process. One teacher referred to the reflection as "the evaluation at the end of the re-teaching." Another noted that the most impactful part of the process for her was, "Thinking about what good lessons are."

In response to the Likert scale items on the survey designed to measure teachers' experience with the reflective component of Lesson Study 83.1% of the participants indicated that practicing Lesson Study had prompted them to *think more reflectively about my own teaching* ($M = 5.37$, $SD = 1.43$) and 78.0% agreed that practicing Lesson Study had prompted them to *think critically about my own understandings* ($M = 5.24$, $SD = 1.26$), while only 39.0% agreed that practicing Lesson Study had prompted them to *feel more valued as a teacher* ($M = 4.25$, $SD = 1.41$). Table 15 shows the scaled survey items used to measure the reflective component of Lesson Study and the corresponding means and standard deviations.

Table 15

Reflective: Responses by Survey Item

Survey Question	% Strongly Disagree - Somewhat Disagree	% Somewhat Agree - Strongly Agree	Mean	SD	N
QL 36: ...think more reflectively about my own teaching.	15.3	83.1	5.37	1.425	59

QL 38: ...think critically about my own understandings.	11.9	78.0	5.24	1.264	59
QL 42: ...feel more valued as a teacher.	25.4	39.0	4.25	1.409	59

Based on a seven-point scale.

Percentages total less than 100% because those indicating "unsure" are not included.

During the interviews, the reflective component of Lesson Study was only directly discussed by Becky. Becky explained that she found reflecting with colleagues about what went well and what did not, and making changes on that basis was valuable. The others who were interviewed alluded to some reflection but did not directly discuss it until asked to rate it at the very end of the interview. Marie described "having the collegiality and professional learning community with my colleagues to look at what's going on in the classroom, and then being able to take it back and reflect with them about what the students are doing has been most valuable."

Student centered.

The student centered aspect of Lesson Study was emphasized by 21% ($n = 8$) of the participants who noted an impact on their teaching from practicing Lesson Study in response to the open-ended survey question. Examples of the value of the student centered process included, "Having to really analyze what students are doing...", "having a specific goal in the lesson based upon what kinds of student

interactions are wanted," "making sure students are doing more of the work, and paying attention to student engagement in the lesson."

In addition, the student-centered aspect of Lesson Study was noted by 31% ($n = 11$) of the teachers reporting components of Lesson Study impacting student learning. The comments about the student-centered aspect of Lesson Study were from both the student-centered lesson planning process and how lessons played out in the classroom. The reports of student-centered lesson planning included "pre-thinking what students might do," "changing the lesson to fit my students' needs," and planning "specific goals for student interaction." In relation to student-centered learning within the classroom, increased student engagement was the predominate theme. One teacher reported, "They are more engaged when they are engaged (doing). The physical movement alone keeps their brains more alert."

During the interviews, two of the four teachers interviewed emphasized the importance of the student-centered aspect of Lesson Study. When asked if practicing Lesson Study had an impact on her teaching beyond the Lesson Study lesson or unit, Becky explained:

Lesson Study made me stop thinking so much about what I was doing and start thinking more about what the students were doing and thinking and saying because it made me acutely aware, I can stand up there and sing and dance and teach all I want to and it doesn't matter if they're not learning. I really need to listen to the conversations in groups and I really needed to pay

attention to the misconceptions that were happening and use those for teachable moments.

While Lana commented, "I like Lesson Study because I really truly feel that I get to see where my kids are coming from."

The responses to the student-centered aspect of Lesson Study, showed a relatively small standard deviation in the mean agreement to the statements (using the reverse of the negatively worded question) ranging from 71.9% in agreement to 79.3%. The most (79.3%) respondents agreed with the statement, "*Practicing Lesson Study has prompted me to think more about my students while planning lessons.*" ($M = 5.16$, $SD = 1.44$) Table 16 lists each scaled survey items used to measure the teacher responses to the student centered aspect of Lesson Study and shows the corresponding means and standard deviations.

Table 16

Student Centered: Responses by Survey Item

Survey Question	% Strongly Disagree - Somewhat Disagree		% Somewhat Agree - Strongly Agree		Mean	SD	N
	Strongly Disagree - Somewhat Disagree	Somewhat Agree - Strongly Agree	Mean	SD			
QL 27: Practicing Lesson Study has had NO impact on my lesson planning.*	71.9	14.0	5.19	1.457	57		

QL 30: ...think more about my students while planning lessons.	13.8	79.3	5.16	1.436	58
QL 43: ...focus more on goals I have set for my students while teaching.	10.3	72.4	5.14	1.249	58

Based on a seven-point scale.

Percentages total less than 100% because those indicating "unsure" are not included.

* This question is a negatively worded question.

Teacher led.

In response to the Likert scale survey items relating to Lesson Study being teacher led, teachers rated the fact that the process is teacher led as the second most impactful aspect of Lesson Study ($M = 5.24$, $SD = 1.53$). However, when asked as an open-ended survey question what about Lesson Study was impactful, none of the respondents directly identified the teacher led component. The teacher led component of Lesson Study was also not directly discussed by teachers during the interview until at the end of the interview when they were asked to rate each component of Lesson Study. During the ratings when asked about the teacher led component Becky responded, "that's where it all starts, you've got to reflect on what you're doing before you can take a look to see how the kids are responding, it's a cause and effect thing." In contrast, Lana responded, "I don't think it is teacher led at all, it's student led for me."

In response to the Likert scale questions associated with the teacher led component of Lesson Study, 84.7% of the participants agreed with the statement, “*I felt I had a lot of influence over the direction of study as a member of my Lesson Study team*” ($M = 5.73$, $SD = 1.16$) and 79.7% disagreed with the reversely worked statement, “*I felt I had little influence over the direction of study as a member of my Lesson Study team.*” ($M = 5.39$, $SD = 1.58$) Table 17 shows the scaled survey items used to look at the teacher led component of Lesson Study and the corresponding means and standard deviations.

Table 17

Teacher Led: Responses by Survey Item

Survey Question	% Strongly Disagree - Somewhat Disagree	% Somewhat Agree - Strongly Agree	Mean	SD	N
QL 2: I felt I had a lot of influence over the direction of study as a member of my Lesson Study team.	5.1	84.7	5.73	1.157	59
QL 29: I felt I had little influence over the direction of study as a member of my Lesson Study team.*	79.7	13.6	5.39	1.576	59

QL 40: ...feel more a part of my school <u>community.</u>	25.4	61.0	4.59	1.599	59
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Based on a seven-point scale.

Percentages total less than 100% because those indicating "unsure" are not included.

* This question is a negatively worded question.

Additional Thoughts on the Lesson Study Experience

A quarter ($n = 9$) of the teachers who claimed that they have noticed a change in student learning because of their participation in Lesson Study discussed changes in their teaching. Some of the changes specified were increases in teacher awareness, confidence, enthusiasm and planning of more hands-on activities. One teacher described her own increased awareness in the following way, "I believe that being involved in Lesson Study is increasing my own awareness which is directly related to student involvement. I'm more keenly invested so the return is also higher."

Another teacher talks about the impacts of Lesson Study in terms of an increased confidence, "I think the biggest impact has been that I feel more confident and willing to try new ways of teaching which makes the class more fun. There is less time spent reading and answering questions and more time doing hands-on. In fact some of my students asked why we are doing so many experiments this year...that's a good thing!" The changes teachers have identified in their teaching are also evidenced through their students. One teacher gave the example, "My ability to present lessons in more engaging ways has helped students become more interested." Others talk about how Lesson Study has led them to feeling more enthusiastic about

what they are teaching and how this enthusiasm spreads from them through their class.

When asked, *"If you feel that Lesson Study has not contributed to your practice in any meaningful way, indicate why"* 39% ($n = 23$) survey participants responded. Of those who responded, 35% ($n = 8$) responded with "N/A", an additional two responded "not sure" and "no comment," while five indicated that they were too early in the Lesson Study Process to be able to fully answer this question, leaving 35% ($n = 8$) responses about why Lesson Study has not contributed to their practice. Of these eight respondents, half indicated that they were already doing the type of teaching they associated with Lesson Study and therefore did not attribute these teaching practices to Lesson Study. Two other respondents referred to a "Lengthy and cumbersome write up" and "too much extra work on top of everything else we must do." Of the other two respondents, one commented that no one else from their own school site was involved, and the other commented that they participated in a different professional development program that had greater impacts on their teaching.

In response to the question, *"Do you plan to continue to practice Lesson Study?"* 93% ($n = 55$) of the total survey respondents answered this question. Of those who responded to this question, 64% ($n = 35$) indicated that they would continue to practice Lesson Study, 7% ($n = 4$), responded that they would not

continue to practice Lesson Study, while the remaining 30% ($n = 16$) reported being unsure if they would continue to practice Lesson Study.

Of those who claimed that they would continue to practice Lesson Study, 57% ($n = 20$) cited the reason for continuing to be based on the valuable experiences they have had practicing Lesson Study. Of those who discussed the value of Lesson Study, seven described changes in their teaching, six specified connections to student learning, and seven others talked in more general terms about the value added to their profession based on practicing Lesson Study. One teacher reported, "It has helped me in developing lesson plans that [are] more meaningful for my students." Another teacher explained, "It is the most effective way I know to really grow as a staff both in content exchange, psychological support and continuous improvement of teaching skills." Others reported, seeing great results from practicing Lesson Study including, focusing on observable student learning, involving more learners, evaluating the effectiveness of Lesson Study based on student learning and understanding, making lesson planning time more productive, helping to meet the needs of individual students, improve student achievement and improve as a teacher. One teacher noted, "It's a valuable tool to use even in a modified form from class to class, not just lesson to lesson."

An additional 20% ($n = 7$) of the respondents who reported that they would continue to practice Lesson Study specifically described the benefits of collaboration. As one teacher reported, "Brainstorming with others gives me ideas,

interventions, and assessments that I may not have thought of by myself." While three others commented on their enjoyment of practicing Lesson Study as a reason to continue. "I hope this opens the gates at our school, that we will do it because we like it and it is beneficial not because we have to. I work with great teachers and I really believe we can learn a lot from each other."

Of the four respondents who indicated that they would not continue to practice Lesson Study, two cited the main reason as not having the money to cover substitute teachers to enable the Lesson Study team to work together and attend research lessons. One of these teachers also indicated that they have a new principal and the school is going in new directions. A third teacher asserted, that they will not continue to practice Lesson Study because it is not useful to his or her area of teaching. The forth teacher reported that Lesson Study was too much work.

Of those who indicated that they were unsure if they would continue to practice Lesson Study, a quarter ($n = 4$) discussed the time it takes to practice Lesson Study as being a barrier. One teacher explained, "I will probably continue some type of informal lesson study. But the formal process is too burdensome and time consuming." Another 25% ($n = 4$) claimed that they were unsure if they would continue practicing Lesson Study because they were considering leaving the teaching profession either temporarily or permanently or were making a shift in the type of teaching they were doing. For example, one respondent explained, "I am not teaching in the classroom. So I have not had the opportunity to continue. If I do go

back to classroom teaching, I would seek out an opportunity to participate in the process again. I think it would be great to modify the Lesson Study practice to using it in my current position in environmental and science education outreach, but I hadn't thought about that idea until now." Nineteen percent ($n = 3$) of those who were unsure if they would continue to practice Lesson Study attribute the uncertainty to being unsure if they will have adequate support to continue after grant funding that is currently supporting the work ends. Additional reasons given for being unsure about continuing to practice Lesson Study include two participants indicating that they want to wait to see the outcomes from practicing Lesson Study before they decide if they will continue or not. Two others commented on a lack of interest from other staff and a difficulty in staying in contact with the Lesson Study team. An additional participant responded, "If it is required, I will do it."

The final question of the main portion of the survey asked, *"Is there anything else that you would like to say about Lesson Study or your experiences with Lesson Study?"* Fifty-six percent ($n = 33$) of the survey participants responded to this question. Of those who responded, two again indicated that they were too early in their Lesson Study process to have more of a response to this question, while an additional 24% ($n = 8$) also gave a response indicating that they had nothing more to add. The remaining 70% ($n = 23$) provided responses that added additional information to what they had already given or provided a summarizing statement.

Of the 23 respondents sharing additional insights about their Lesson Study practice in response to this question, 35% ($n = 8$) commented on the difficulty of finding the time to practice Lesson Study. The comments included acknowledgement that Lesson Study take time, expressing that too much time is required for Lesson Study, challenges in fitting the whole teams' schedules together to be able to meet and a wish to streamline the process. Thirty percent ($n = 7$) made suggestions on how Lesson Study could be changed or expanded. Two people stated that it would be helpful if Lesson Study was used and supported district-wide. A third teacher explained that her team had consisted of regular science teachers along with a special education para-educator and she offered their experience as a model of collaboration and building of respect between different types of staff within a school. Another teacher suggested, "It would be great to have beginning teachers experience this process early on in their career." One teacher expressed that the Lesson Study process was beneficial, however, the time spent to complete the report and presentation was too extensive. Yet another respondent asserted that it would be more valuable if teaching techniques were being specifically observed, not limiting the observation to focusing only on the students.

The value of teacher collaboration was emphasized again in response to this question with 17% ($n = 4$) commenting favorably about working with colleagues as part of the Lesson Study process. In contrast, another 17% ($n = 4$) expressed difficulty with the Lesson Study based on a lack of clarity about the process, limited

facilitation, or feeling confined by too narrow of a focus. Other responses included reports of changes in teaching, comments about Lesson Study as a beneficial experience, and a desire to continue to practice Lesson Study. One teacher summarized, "It does take time, but knowing the drill from one year to the next helps a lot. Working collaboratively with fellow teachers is wonderful, especially in a school with no common prep periods and sometimes isolated geographically. It has helped me get out of my room and talk to other teachers. I have really seen the value in the lesson study." Another teacher commented, "The thing I enjoyed most was being able to see how other teachers taught a lesson and then discussing what we could do to improve it. That led to some real breakthroughs in ways to teach the content. It just felt like it was a lot of work so that just one lesson would be improved. I wish there were a way to streamline it or have more lesson[s] in the process."

In response to being asked if they would be willing to be contacted for a follow-up interview, 75% ($n = 44$) of the survey participants responded. Of those who responded, 75% ($n = 33$) specified, "*Yes, I'm willing to be contacted about participating in an interview*" while 25% ($n = 11$) of those who responded indicated, "*No, I would prefer not to be contacted for an interview.*"

CHAPTER FIVE

ANALYSIS

As part of this study a tool for measuring teacher perception of the impacts of practicing Lesson Study on teaching effectiveness and student learning was developed and validated. Additionally, this study explored the components of Lesson Study to establish which were most strongly associated with reported impacts on the respondent's teaching and student learning. This chapter discusses the results and offers an analysis of how the study results shed light on the initial research questions as well as connect to literature of the field. After an overview the discussion is arranged in sections by research question.

Summary of Findings

Overall, study results find the largest impact from practicing Lesson Study is on the teachers' perception of their own effectiveness, particularly in their ability to match instructional strategies to students and their teaching confidence. Although some effect on student learning was also reported, the student learning variables were not as strongly associated with the Lesson Study experience as those directly related to teaching practice. This could be because increasing student learning is a secondary impact from practicing Lesson Study. It is the teachers themselves who engage in the practice of Lesson Study resulting in the most likely short-term impact

being on the teacher's own perceptions of their teaching effectiveness. Increased student learning as a result of Lesson Study can only occur as a secondary result of increased teacher effectiveness as stated by the National Education Policy Center, "Teaching effectiveness can be considered the result of teacher activities" (Hinchey, 2010) . James Stigler and James Hiebert report in *The Teaching Gap*, "Improving complex systems, such as teaching, requires a relentless focus on the bottom-line goals--in this case, students' learning--and a commitment to evaluate changes with respect to these goals." Bruce Joyce and colleagues add (as cited in (Stigler & Hiebert, 1999), "In all reported cases of school improvement initiatives in which substantial student learning occurred, school staff kept students' interests as learners central throughout the planning, implementation, and assessment phases."

When asked how her teaching has changed as a result of Lesson Study, a study participant responded, "In the process of increasing my awareness in the moment of how each student is/is not engaging and learning the activity/lesson. Also in the process of developing lessons that incorporate more learning styles into lessons." Another teacher reported, "I've learned more efficient strategies to get my students engaged in the learning process."

In response to an open-ended question asking teachers to identify any evidence of impacts of Lesson Study they could see on their students learning, a majority (73%) noted impacts. As one teacher summarized seeing "more engagement, more student understanding, more class participation." Another teacher

reported, "students remain on task, and want to participate." Those who are newer to practicing Lesson Study may start to recognize some changes in their teaching or the way they think about teaching and student learning, but it may be too soon to be able to see measurable changes in student achievement.

Of the components of Lesson Study identified by the study there was significant agreement among survey participants that the collaborative aspect of Lesson Study was the most important in improving teaching effectiveness and student learning. Teachers reported that the collaboration enhanced the student centered, content focused and reflective components of Lesson Study. James Hiebert and James Stigler (2000) in an article on lessons learned through the TIMSS video study about improving teaching explain:

While teachers are producing sharable work, they are engaged in exactly the kind of learning that they need to become more effective teachers. They must learn more about the subject, about their students' thinking, about alternative pedagogies. The lesson study process assumes this kind of learning and offers opportunities to learn through collaboration with and observation of colleagues, as well as time for study and reflection. (p.12)

Teaching Effectiveness

The National Research Council defines teaching effectiveness as "the ability to produce desired changes within the classroom" (National Research Council, 2001, p.4). Teachers' perception of their effectiveness was measured in terms of the ability

to match instructional strategies to student needs, level of teaching confidence, and assessment of student learning and assessment of student work.

Teachers report that Lesson Study has led to changes in their teaching and the way they think about lesson planning. In response to the scaled survey items, participants indicate that practicing Lesson Study has had the greatest effect on their ability to match instructional strategies to student learning styles and needs. In interviews and written comments, several respondents noted that they are now more careful in thinking about their students and their different learning styles while planning lessons and teaching and are more attentive to signs of student learning. Through the discussions that arise while working intently with a team to define specifically how student learning will be measured during a research lesson teachers are prompted to think more concretely about how student learning can be seen and measured while teaching. As one teacher described, "By having someone come in and observe my lesson, watching her teach the same lesson and then talking about it, I felt I had a better understanding of what might confuse my students, how to change questions, and lab set up to get more out of the lab from the student's perspective." Another teacher reported, "It [Lesson Study] makes me think more about each individual student and their learning when I am planning my lessons." When asked how her teaching has changed as a result of Lesson Study, another teacher responded, "I've started using data obtained from assessments to better my instruction and student performance."

Increased teaching confidence was also reported as being a benefit of Lesson Study. The effect on teacher confidence was evident with high ratings on the related scaled survey items as well as frequently reported in responses to an open-ended survey question asking how their teaching had changed as a result of Lesson Study. Several themes emerge from the data on teacher confidence. Some teachers reported that practicing Lesson Study was often confidence building because it reaffirmed theories on teaching and teaching practices they already held. They talked about the data they gathered on student learning while practicing Lesson Study as evidence that the teaching practices they were using were best practices. Interestingly, when talking with the teachers during the interviews, all four of the teachers interviewed, talked about how practicing Lesson study has confirmed the benefit of teaching practices that they already believed to be valuable. Two of the interviewed teachers talked about this confirmation of their ongoing practice as being reassuring and confidence building, while the other two claimed that practicing Lesson Study did not increase their teaching confidence. It was explained by these two that Lesson Study was not confidence building because for one, she was already confident and for the other, she already had learned and was using the teaching practices that she used during the Lesson Study. For those already using the teaching practices that their group adopts as part of their Lesson Study, it appears that for some the Lesson Study experience serves as a confirmation and in turn increases their confidence in their teaching, while for others who are already using the practices Lesson Study

seems less valuable in terms of building confidence in their teaching because they are continuing practices they are already using and believe to be successful. However, an analysis of the survey results shows that the majority of teachers who participated in this study reported practicing Lesson Study helped to build their teaching confidence and that the increased confidence that they gained had a positive impact on their effectiveness as teachers. As one teacher reported in response to being asked what about Lesson Study most impacted her students' learning, "I think the biggest impact has been that I feel more confident and willing to try new ways of teaching which makes the class more fun. There is less time spent reading and answering questions and more time doing hands on."

The literature on teacher self-efficacy (Bandura, 1993) suggests that increased confidence may lead directly to greater teaching efficacy and in turn improve teaching effectiveness. According to Bandura (2000), not only are teachers with a greater sense of efficacy more willing to try new things, they are more confident that they will be successful and are more resilient to setbacks if things do not go well. A large body of literature (Bandura, 1993; Riggs & Enochs, 1998; Tschannen-Moran & Hoy, 2001; Tschannen-Moran, A. Hoy & W. Hoy, 1998) suggests that higher levels of teacher efficacy will produce better student achievement. Based on this, teachers' reports of increased confidence from practicing Lesson Study may also contribute to improved student achievement.

Over a third of the participants in the study indicated that practicing Lesson Study has increased their awareness of student learning and gave examples of how this manifests in their teaching. This increased awareness in student learning, in particular watching students reactions while teaching and being aware of their interactions with the lesson, affects teaching far beyond the specific Lesson Study lesson or unit of study. Being attuned with how students are processing information and how they are learning often causes a shift in the way teachers teach. As Eleanor Duckworth emphasizes, "it is by paying attention to what *they* are thinking and doing that *we* as teachers can see how next to call on our knowledge of to the subject matter--what resources to provide, what next questions to ask." (2009) For those newer to Lesson Study who are starting to observe students more carefully for evidence of learning it may be too early to specifically identify changes in student learning. First the teacher must become aware of the levels of their students understanding before they can effectively assess if there are changes in the levels of student learning.

In response to the types of assessment used, participants seem to prefer some types of assessments over others. Teachers practicing Lesson Study tended to place a greater emphasis on the value of hands-on, performance-based assessments. In response to being asked if her assessment practices had changed since practicing Lesson Study, one teacher responded, "Yes, more accurately and authentic. No more multiple choice..." Most (57%) of the respondents to this question claimed that since

practicing Lesson Study, they do assess their students differently, of those, nearly half indicated that they now use more informal assessment and authentic performance based assessment.

As teachers are reporting a shift in the ways they are teaching to using more hands-on, student directed, inquiry based lessons, it is not surprising to see that they are also changing the way they assess students. When students are taught in more interactive ways, it is logical that the assessment of what is being learned would also be done in a manner that is more reflective of the learning experience, for example through authentic assessment such as performance based assessments, labs and situation based problems.

Engaging in Lesson Study makes school a place of learning for teachers as well as students. The practice of Lesson Study addresses many of the factors noted in the literature as limiting teaching effectiveness. Teacher reports from this study as well as past studies suggest that a teacher working collaboratively with other teachers is beneficial in increasing teaching effectiveness. As reported by study participants, Lesson Study brings teachers together to work toward a better understanding of how their students learn, how to assess that learning and how to teach in a way that strengthens student learning.

Impact on Student Learning

The impact of Lesson Study on student learning was measured in terms of perceived student interest and expression of thinking. Student interest was a measure

of the perceived level of engagement in lessons, while students' expression of thinking focused on the ability to share their thinking and respond to others.

The elements of student interest and expression of student thinking used within the student learning construct were affirmed by responses teachers gave when asked about changes in teaching practice resulting from practicing Lesson Study. When the participating teachers discussed increased awareness of student learning, they gave examples of levels of student engagement, and student response to curriculum along with discussing their own increased ability to identify student misconceptions.

When asked directly, *"If you have noticed an impact on student learning, what about Lesson Study do you think most contributed to the impact?"* the collaborative, student centered, content focused aspects of Lesson Study were the most strongly evidenced by the responses. Additionally, many teachers claimed a change in their teaching. Although only the responses from teachers who specifically indicated a change in teaching were reported in the coding system used for the results, it appears that a change in teaching is likely the driving force behind much of the impacts reported as student centered, collaborative, content focused and reflective. For example, if practicing Lesson Study is leading teachers to more closely examine and consider student learning while they are planning lessons and teaching, which in turn is leading to increased student engagement, this too is evidence that practicing Lesson Study is leading to a change in teaching practice

which in turn results in increased student achievement. These same phenomena can also be seen in the collaborative and content focused components of Lesson Study.

Many survey responses suggested that the teachers themselves were in the process of learning to better interpret signs of student learning. As one teacher describes, "We are still in the process of developing our first Lesson Study but I am already teaching from a place of increasing awareness and spot checking in the moment more often so this is also increasing the student involvement and fewer students are moving ahead without comprehending what came before in lessons that require some scaffolding and memory retention."

Teachers reported that practicing Lesson Study had impacts on their students' learning as evidenced by increased student engagement, more expression of thinking by the students and improved student comprehension. In addition, teachers reported being better able to notice these impacts because through practicing Lesson Study they have become more keen observers of student learning. This is an example of how effects of teachers practicing Lesson Study are translated through them into their classroom and reflected by their students. It is through this transmission of more deeply looking at teaching and learning at both a teacher and a student level that Lesson Study will have the greatest ability to transform not only how we teach, but also how we learn.

Components of Lesson Study

Of the teachers who reported that practicing Lesson Study had an impact on their teaching and student learning this study examined which components of Lesson Study were most associated with the teacher reported impacts. The components examined were student centered, teacher led, collaborative, content focused and reflective. Across survey scaled response, open-ended response and interviews the collaborative aspect of Lesson Study received the highest rating and was by far the most often identified as being experienced through practicing Lesson Study and as having an impact on both teaching and student learning. There was more variation in the reports on the other components of Lesson Study. When teachers were asked to identify which aspects of Lesson Study had the most impact on their teaching, after collaboration, the content focus and reflective elements of Lesson Study were the most frequently identified. When asked which components of Lesson Study had the greatest impact on student learning, after collaboration teachers identified the student centered and content focused aspects of Lesson Study as having the greatest impacts.

The results from the Likert scale questions asking about practices prompted by Lesson Study varied some from the results to the open-ended questions. Based on the Likert scale questions, after collaboration, survey respondents gave the highest ratings to the teacher led and student centered aspects of Lesson Study. Some of the differences between the responses to the open-ended questions and the scaled response questions may be due to the nature of the survey and the manner in which

the questions were asked. On the scaled response items, participants were asked to rate the degree to which they agreed or disagreed with a number of statements, each of which was already a predetermined part of the study construct. These items were designed to measure the extent to which teachers felt their practices were changed based on Lesson Study. In contrast, for the open response items the respondents were given a question and asked to give the response in their own words which were then post-hoc coded based on the survey construct. These responses asked teachers to describe what aspects of Lesson Study specifically had an impact on their teaching and student learning. Each of the components of Lesson Study that were examined in this study are discussed in more detail in the following sections.

Collaborative.

The results of this study indicate that teachers found the collaborative aspect of Lesson Study to have had the largest impact on their teaching and student learning. Teachers reported that the collaborative nature of Lesson Study improved their teaching through sharing ideas, working together to remedy challenges, and built their confidence as teachers. The strong theme of collaboration was reported to be spread beyond the Lesson Study teams providing evidence of the building of a community of learning between teachers as well as within the classroom among students and between teacher and students. It has been said that a cultural shift is needed to truly make the changes necessary in our schools (Stigler & Hiebert, 1999). This is an example of how the culture of learning can spread from a group of teacher

into their respective classrooms. Moreover, teacher reports indicate that the collaboration experienced as part of Lesson Study was the basis for other reported impacts such as increasing content knowledge, focusing more specifically on evidence of student learning and reflecting on one's own teaching practice. In this way the results of this study confirm that collaboration plays a core organizing role in the Lesson Study process.

Teachers come together to work toward jointly held goals. The efforts manifested through the collaboration are what lead to the development of work that is content focused, student centered and reflective. This suggests that building a strong collaborative foundation is key to the success of Lesson Study. It is questionable if some of the other components of Lesson Study could develop without a strong collaborative base.

Content focused.

The content focus of Lesson Study was also noted by the teachers as significantly impacting both their teaching and student learning. In response to the open-ended questions asking which components of Lesson Study had the greatest impact on teaching and student learning the content focus was identified as second most impactful on their teaching and third most impactful on student learning. Interestingly, in response to the Likert scale questions teachers gave the lowest rating of the five components measured to the content focus questions. This could be in part due to the nature of the scaled items used to assess the content focused components.

Two of the scaled response questions that received weaker scores of agreement addressed identifying and admitting gaps in teacher content knowledge. Teaching practices tend to be held privately to oneself, and sharing and questioning practices and beliefs, although necessary for improvement, can be difficult (Snow-Gerono, 2005). For this reason, identifying gaps in one's own content knowledge and sharing those findings with others may well be one of the more uncomfortable aspects of Lesson Study. In addition, when asked at the beginning of the survey to rate the importance of a variety of elements on contributing to effectiveness as a teacher, "increasing your own content knowledge" was not rated by survey participants as nearly as important as several other factors.

Reflective.

The reflective component of Lesson Study was identified as the third most impactful component of Lesson Study in terms of teaching practices, falling very closely behind content focus, however was rated lower in response to the Likert scale questions asking about Lesson Study prompting reflective practices and quite low in terms of impacting student learning. The lower rating given based on the Likert scale questions appears to be largely due to the statement "*Practicing Lesson Study as prompted me to feel more valued as a teacher.*" Only 39.0% of respondents agreed to this question while 83.1% and 78.0% respectively agreed to the other two statements in the reflective practice construct. When respondents were asked at the beginning of the survey how important they felt a variety of aspects were in their

effectiveness as teachers, "reflecting on the effectiveness of a lesson" was most frequently identified as important. It is possible that teachers who tend to engage in Lesson Study also tend to already be reflective about their practice and therefore did not experience a large change in this way due to practicing Lesson Study. Additional survey items asking about practices prior to beginning Lesson Study would be needed to further assess this theory.

Student centered.

The student centered component of Lesson Study was rated highly in response to the Likert scale questions asking about reflective teaching practices prompted by practicing Lesson Study. The student centered aspect of Lesson Study was also reported to have a significant impact on student learning. Teachers most frequently cited the student centered component of Lesson Study as impactful when they were asked about the impact that practicing Lesson Study had on student learning. Responses to the open-ended question mirrored the Likert scale prompts used to measure the student centered aspect of Lesson Study, confirming that thinking about students while planning lessons and focusing on goals set for students while teaching were measures of student centered teaching behavior with which the survey participants identified. In terms of teaching effectiveness the student centered aspect of Lesson Study was not reported to have as great of an impact as other components of Lesson Study.

Teacher led.

There were mixed results to the teacher led component of Lesson Study. In response to the Likert scale questions, respondents indicated strong agreement, second only to the collaborative component, that practicing Lesson Study had prompted them to feel more a part of their school community and that they felt they had a lot of influence over the direction of their Lesson Study. However, the teacher led component of Lesson Study was not mentioned in the open-ended responses or discussed to a large extent during the interviews. The comment from Lana about Lesson Study being student led rather than teacher led when asked about the teacher led component of Lesson Study during the interview, may shed some light on why teachers strongly agreed with the Likert scale items designed to look at the teacher led aspect of Lesson Study, meanwhile did not mention the teacher led aspect of Lesson Study in their open-ended response or during the interviews. Given the opportunity to shape a professional development experience it may be that teachers are making the choice to focus on the collaboration with colleagues and on students, but are not defining these experiences as being teacher led. In a study by Stewart and Brendefur (2005) a teacher reports, “There is power in collaborative planning. There is value in observing colleagues teach. My thought processes were stimulated, and it helped to organize my thoughts about teaching a lesson. My focus on instruction has been brought to a higher level. This process is less teacher directed and more student centered in lesson planning.” (p.6) This comment again deflects the teacher led

aspect of Lesson Study and focuses on the collaborative and student centered aspects while still making note of the teacher driven process. The Likert scale items on the survey designed to look at the teacher led aspect of Lesson Study focus on lesson planning as it relates to students. These items might be a better measure of respondents feelings about their ability to connect their lessons to their students than about their feeling of leadership. However the motivation, enthusiasm and dedication often reported as stemming from a feeling of ownership over one's own professional development are evident in study respondents.

When surveyed teachers were asked to identify how their practice of Lesson Study has had an impact on student learning, teachers frequently reported changes in their own teaching. Although these reports of changes in teaching practice impacting student learning were not recorded as teacher led in the results, they may indeed be an indication of a teacher led process. The extent to which teachers feel that they have autonomy in their own teaching and the ability to increase student engagement and achievement they are empowered. Seeing the positive impacts of one's own changes in teaching is also likely to increase teacher confidence and in turn perceptions of teaching efficacy.

Barriers to Lesson Study

A lack of time and difficulty in scheduling were reported as the most significant barriers to practicing Lesson Study. The most often identified barrier to practicing Lesson Study was time. Respondents reported that it was difficult to find

time in their own schedules to be part of a Lesson Study team as well as difficult to schedule Lesson Study meetings at a time that would work for everyone on the team. The Lesson Study process is time consuming and generally is not built into teachers' regular work days and must be done in addition to their normal duties. The extra time spent engaging in this process is often uncompensated monetarily, unless teachers are involved in a separately funded grant program that funds their Lesson Study work. For some teachers working in smaller schools, it can also be difficult to form a team due to a limited number of other teachers at their school and/or in their area. Even with these challenges, 64% ($n = 35$) of the survey respondents reported that they planned to continue practicing Lesson Study, 30% ($n = 16$) indicated that they were unsure and only 7% ($n = 4$) responded they did not plan to continue to practice Lesson Study.

Challenges and Limitations

One challenge of analyzing the results from this study was the overlap between responses to multiple research questions. For example a key measure of teaching effectiveness is impact on student learning meaning that by definition the two research questions are intertwined. In addition to the connection between the broad research questions, the subcomponents are also highly connected. "Assessment of student learning" was used as a measure of teaching effectiveness, however and ability to assess student learning is necessary for being able to report impacts of Lesson Study on student learning. In an effort to address each research question, the

results were primarily analyzed by research question and sub-component of the survey construct. It is possible, however, that if all of the data had of been pooled and analyzed together different insights may have been gained.

Significance of Key Findings

Many who practice Lesson Study report the experience to be worthwhile, enjoyable and confidence building. Extensive past research indicates that building teachers' own feelings of confidence in their teaching is a significant factor in their effectiveness as teachers particularly in terms of student learning (Bandura, 1993; Riggs & Enochs, 1998; Tschannen-Moran & Hoy, 2001; Tschannen-Moran, A. Hoy & W. Hoy, 1998). As teacher efficacy increases, their teaching improves and so does student learning. As mentioned in the literature review for this study, Bandura (1994) suggests four ways for creating and strengthening self-efficacy: 1) experiencing success in accomplishing something one has worked hard toward, 2) through vicarious experiences of seeing someone else's sustained effort lead to success, especially if the other person is similar to oneself, 3) social persuasion and encouragement from others that one is capable of accomplishing a goal leads to a greater amount of sustained effort resulting in an increased likelihood of success, 4) reducing stress resulting in a more positive mood also leads to a greater sense of self-efficacy. Each of these elements suggested by Bandura for creating and strengthening self-efficacy are experiences frequently present in Lesson Study teams. Furthermore, the five common themes (focus on content knowledge and student

outcomes, classroom based training, collaboration among teachers, professionalism, and sustained training) identified in the literature review as being frequently cited in effective teacher professional development are also all present in Lesson Study and identified by teachers of this study as impactful. The implications of these findings and suggested further research will continue to be discussed in the conclusion.

CHAPTER SIX

CONCLUSION

Overview of the Study

With increasing pressure on schools and teachers to demonstrate gains in student achievement and a growing awareness of the large cost of teacher attrition, the ways in which teachers are supported must be examined. Many studies have been conducted looking at teaching effectiveness and student learning and an increasing number of studies are emerging on the practice of Lesson Study in the United States. There is however, a very limited amount of research examining the impacts of practicing Lesson Study on teaching and learning, and which attributes of Lesson Study leads to those effects. This study is a step toward better understanding the ways Lesson Study leads teachers to report improvements in their teaching and increases their focus on student learning within their classrooms.

This study sought to measure which components of Lesson Study had the largest impacts on teaching and learning. Based on a review of literature, a set of study constructs were developed to measure teacher-reported impacts of practicing Lesson Study on their teaching and on student learning. A mixed-methods approach was used to gather data. In this study, 59 teachers were surveyed from four different California Science Project sites. The survey was comprised of scaled, ranked and

open-ended items. Follow-up interviews were conducted with one teacher from each of the four California Science Project sites.

Once the data were collected, statistical analysis tested the survey instrument for reliability and validity in relation to the study constructs. Development of a survey instrument with reliable and valid measures of the constructs of teaching and learning in relation to Lesson Study was an important outcome of this study. It was developed with the intent that it be used to facilitate further research.

Overall, teachers participating in this study reported that practicing Lesson Study had a great impact on their teaching. Two of the most frequently reported effects of practicing Lesson Study were: 1) their ability to match instructional strategies to their students' learning needs and 2) increasing their confidence in their teaching abilities. The collaboration among teachers practicing Lesson Study was identified as having the greatest impact on increasing teaching effectiveness and in turn student learning from both the scaled and open-ended survey items, as well as from the interviews. In fact, many teachers indicated that the collaboration they experienced as part of Lesson Study helped them to become more student centered, content focused and reflective in their teaching and helped to build confidence in their teaching abilities.

Lesson Study's impact of building teachers' own confidence in their teaching abilities is likely the most significant finding of this study. Teachers reported that practicing Lesson Study increased their confidence giving them a greater sense of

efficacy about their teaching. Many studies have shown (Bandura, 1993; Riggs & Enochs, 1998; Tschannen-Moran & Hoy, 2001; Tschannen-Moran, A. Hoy & W. Hoy, 1998) that when teachers feel as though they are more effective, that alone leads to better teaching and increased student learning. Due to this, the positive impact teachers report from practicing Lesson Study to a large extent may be drawn from the fact that practicing Lesson Study leads teachers to feel more effective in their teaching practice.

Implications

The positive role of teacher collaboration in schools is becoming more widely recognized. As cultural practices change in the United States toward more teacher collaboration, practices such as Lesson Study will likely become more feasible to implement. With a growing awareness and recognition of the value added when teachers have the opportunity to work together to plan lessons, evaluate student work, explore curriculum and reflect on teaching practices in relation to student learning, shifts are taking place in school schedules that allow for teacher collaboration time.

Providing time for teachers to collaborate removes one of the largest roadblocks to Lesson Study in the United States. In fact, as this shift is taking place and teachers are gradually spending more time working together, Lesson Study could serve as an ideal model to help facilitate the new teacher collaborations. The Lesson Study process provides a framework to help guide the collaboration amongst

teachers while still providing a great deal of opportunity for teachers to take the lead in determining the direction of their work together. There are still challenges to overcome, as practicing Lesson Study requires a shift in thinking from focusing solely on delivering content to focusing on how students will interact with the content of the lesson and how learning will occur. Teachers also have to be learners in the process - examining their own misconceptions and exploring new ways of teaching to address the increasingly diverse learning needs of their students.

Teachers in this study reported that by working together and using the Lesson Study process they built a stronger set of teaching skills, became more aware of student learning needs, and developed strategies to meet those needs. As other studies demonstrate, teaching success with students and positive interactions with colleagues help to reinforce teaching confidence and as a result supports continued improvement in student achievement. With an increased sense of teaching efficacy, teachers are more likely to work harder to continue to improve their practice and will likely be more resilient to setbacks (Bandura, 2000).

Limitations

Although valuable information for the community of Lesson Study coordinators and practitioners can be gained through this study, there are a number of limitations to this study. One limitation is that data was not gathered prior to teachers starting to practice Lesson Study. It would have been very useful to have been able ask these teachers to rate their impressions on how important that each

component of Lesson Study was to their effectiveness as a teacher prior to practicing Lesson Study and then again after practicing Lesson Study. Gathering data both before a teacher began practicing Lesson Study and then after, would have enabled more of an opportunity to measure changes in teachers system of values regarding teaching and learning and their perceptions of various professional development activities based on their involvement in Lesson Study.

This study is also limited in terms of sampling bias. Due to being a survey of convenience it may not be representative of all teachers practicing Lesson Study. It is possible that those who had a stronger and more positive experience practicing Lesson Study may have been more likely to complete the survey. The survey portion of this study was self-administered allowing responses from more teachers about their Lesson Study experiences. It was limited however, by the fact that the researcher was not able to clarify questions that might have seemed ambiguous to the respondent or ask probing questions for more details. Despite these limitations, this study tests this survey instrument and sheds light on common themes that teachers report associated with participating in Lesson Study and provides a window into some individuals' experiences and assesses some of the impacts on teaching and learning.

Recommendations for Further Research

Studying the effects of Lesson Study is especially challenging because of the many variables, such as differences in training and support, level of teaching

experience, and school culture. A larger sample size would help to mitigate some of the effects of these variables and would lead to more generalizable findings.

The statistical analysis of the data done to evaluate reliability and validity of the survey instrument suggests that the scaled items on the survey may be useful measures for future studies that examine the impact of Lesson Study on teachers' perceptions of their effectiveness and student learning. The responses to the open-ended survey items and the interviews provided additional detail about teachers' experiences practicing Lesson Study that largely supported the findings of the quantitative analysis. Items from this instrument may also be able to be modified for studying other forms of professional learning communities. Additionally, a pre/post comparison of teachers before they begin practicing Lesson Study and then again after practicing Lesson Study would allow for additional insights into changes in perception of teaching and learning during the course of practicing Lesson Study.

More research is also needed on which elements of Lesson Study are most important for increasing teaching efficacy. The components found to be effective in increase teaching efficacy need to be explored further to identify to what extent and how that increased teaching efficacy translates into improved student achievement. If similar studies were conducted on multiple forms of professional learning communities, the best practices of each could be used as the basis for new models of professional development that might offer greater efficiency and enhanced outcomes. With a better understanding of what leads to increased student achievement, our

educational system might shift toward a practice of training and supporting teachers in ways that optimize time and effort for improved student learning.

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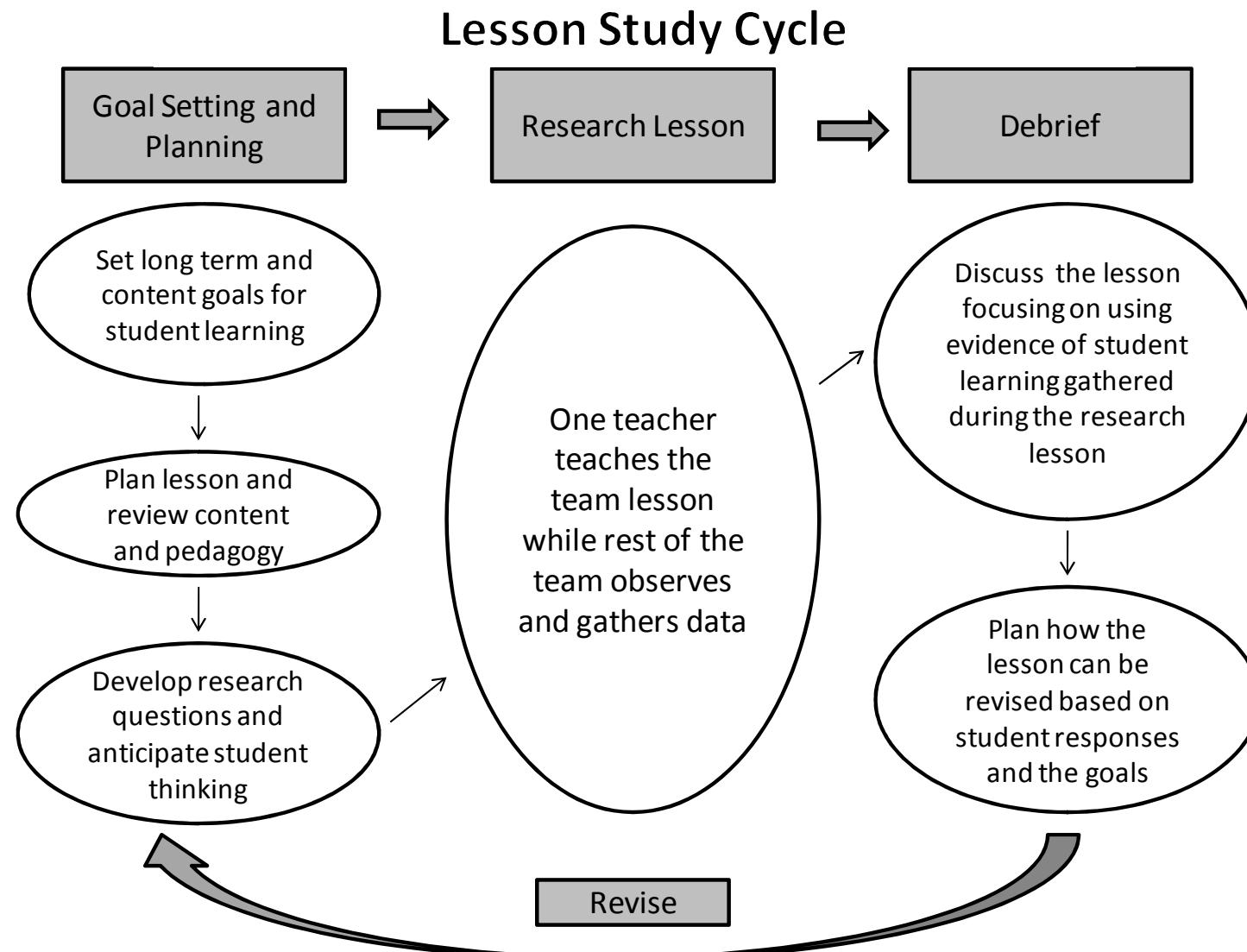
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APPENDIX A



APPENDIX B

Survey of Lesson Study Practice

Please contact Julie Van Sickle for a copy of the survey used for this study by email at jav16@humboldt.edu or by phone at (707)845-8725.

APPENDIX C

INFORMED CONSENT
HUMBOLDT STATE UNIVERSITY
Lesson Study's Impacts on Teacher Perceptions of Efficacy in Teaching
CONSENT TO ACT AS RESEARCH SUBJECT

This research study aims to better understand the experience of teachers of K-12 students who are practicing or have practiced Lesson Study. The information gathered during this study will remain confidential and will be used only for the purpose of researching components of professional development and Lesson Study experiences.

Procedures include:

This research study includes a survey that will take you approximately 30 minutes to complete. The survey is composed of short response, rankings and scaled responses. At the end of the survey, you will have the opportunity to indicate a willingness join a pool of teachers from which a select number will be chosen to participate in a follow-up interview. Choosing not to participate in a follow-up interview will in no way impact the usefulness of your responses to the survey questions. You may skip any questions on the survey or in the interview that you are not comfortable answering and may withdraw from the study at any time with no penalty.

Risks and Benefits:

The potential risks for participating in this survey are very minimal, however, participating in the study will take time that could otherwise be used in other ways and could potentially challenge one's self confidence if after participating in this survey you realize that the program is not accomplishing much as initially thought. Additionally, by sharing one's experiences they are made more public, however, this risk will be minimized by carefully keeping the data shared confidential. To assure confidentiality, data will be pooled before being reported and pseudonyms will be used in place of real names. Participating in this study could benefit you by giving you a chance to discuss your work, and in turn possibly think about it in new ways. Your responses will also be valuable in planning for future professional development work.

I understand that if I have questions about this study at anytime I may contact Julie Van Sickle, researcher at jav16@humboldt.edu or (707) 826-5552, or Dr. Keri Gelenian, faculty advisor at kg5@humboldt.edu or (707) 826-3738. I also understand that my participation in any study is entirely voluntary and that I may decline to enter this study or may withdraw from it at any time without jeopardy. I understand that the investigator may terminate my participation in the study at any time. I understand I am not receiving any compensation for participating in this study

Signature

Date

APPENDIX D

Interviewee: _____**Interview Date/Time:** _____**Method of Contact:** _____**CSP Site:** _____ **Grade Level Teaching:** _____ **Yrs Teaching:** _____**LS Experience:** _____

I am interested in learning about your experiences and views on teaching science/mathematics.

1. As a science/mathematics teacher, what types of things do you see influencing student's learning of science/mathematics concepts? (theory on learning/teaching)

1a) How have you arrived at this theory on learning/teaching?

1b) What has influenced your theory?

2. What types of professional development have been most beneficial in shaping your teaching practices?

2a) What is it about these professional development experiences that have been influential?

I would also like to talk with you about your experiences practicing Lesson Study.

3. Please describe your overall Lesson Study experience. (*Give time to talk generally about the experience, gently probe for feelings about experience.*)

3a) What has been/is/was one of the most positive aspects of practicing Lesson Study?

3b) Are there/were there any negative aspects of practicing Lesson Study?

4. Has practicing Lesson Study changed any of your conceptions of teaching and learning in science/mathematics?

4a) Can you give an example of how you have seen these changes in your teaching?

5. Do you feel practicing Lesson Study has increased your confidence as a teacher? If so, how?

6. Do your experiences practicing Lesson Study extend to your teaching beyond your Lesson Study lesson or unit of study? If yes, in what ways?

I'm going to ask you about a series of components that are often attributed to Lesson Study. For each one I would like you to give it a numerical rating as well as an explanation of how you are ranking it. The rating is on a scale of 1-5, one being not useful and five being very useful.

7. To what degree have you found each of the following components of Lesson Study to be useful to you? Ask for both a scaled numerical response as well as an explanation, if useful, what was useful about each.

7a) _____ Collaboration with colleagues

7b) _____ Focus on content knowledge

7c) _____ Focus on student learning

7d) _____ Time and space for reflection

7e) _____ Teacher led

8. Is there anything you would like to add?

Thank you for taking the time to talk with me.

APPENDIX E

LESSON STUDY TOPICS AT TIME OF STUDY

- writing paragraphs in science
- weather: thunderstorms (3)
- water filtration, water cycle (2)
- tree planting
- the use of white boards and Socratic dialogue to improve lab conclusions and understanding
- moon phases
- Boston Tea Party
- test review activities
- teaching algebra conceptually
- teacher wait time
- systems and cycles in science
- successful implementation of experimental design in science labs (2)
- stream erosion
- states of matter and phase changes
- solar system
- slope and flooding affect erosion
- science vocabulary
- science convection currents
- rocks and minerals (2)
- radioactive decay and radio carbon dating (3)
- muscle system, motion
- modeling approach to earth science
- matter
- increasing student communication
- graphing (3)
- digestive system (4)
- and conceptual knowledge

