QUALITY PROFESSIONAL DEVELOPMENT FOR SECONDARY SCIENCE TEACHERS

A Record of Study

by

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ABSTRACT

This record of study (ROS) explores the perceptions of three high school biology teachers who implemented a form of the Japanese originated Lesson Study Professional Development (LS PD) model. Additionally, this ROS reports on the perceptions of the internal stakeholders with regard to the model's viability as a potential solution to a proposed problem of practice where there was a lack of quality professional development for secondary biology teachers. The audience of internal stakeholders includes district administrators, high school teachers, and science teachers from the elementary and middle school grade levels.

Participants of this study collaboratively explored the problem of practice in the fall semester of 2015, then implemented the LS PD model in the spring semester. The participants completed three cycles of LS that focused on collaboratively designing research-based lessons, teaching the lessons with peer observations, revising and re-teaching the lessons with peer observations, and reflecting on the participants' growth experiences. Four research questions were addressed: (a) What are the perceptions of the participants in regard to their own professional growth as a result of participating in the LS initiative? (b) What improvements to the LS PD model might facilitate future implementation? and (c) What are the perceptions of the LS dissemination audience toward LS as a viable solution to a lack of quality PD for secondary biology teachers?

Results of the study suggested that LS PD may be a viable solution to the proposed problem of practice where there is a lack of quality professional development

for secondary biology teachers. Long-term implications posit that LS PD can be adapted and scaled up to benefit all content areas and grade levels.

NOMENCLATURE

LS	Lesson Study
MVHS	Middle Valley High School
PD	Professional Development
STAAR	State of Texas Assessment of Academic Readiness
TEKS	Texas Essential Knowledge and Skills

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CHAPTER I

INTRODUCTION

Significance

Wei, Darling-Hammond, and Adamson (2010) presented an executive summary of an exhaustive two-phase research study analyzing professional development (PD) perceptions of 35,800 teachers in the United States. The summary reported that schools in the United States lag behind other countries in the amount of extended time for collaborative learning opportunities for in-service teachers. The report described a comparison between secondary and elementary schools in the United States where elementary teachers received significantly more PD for content specific training and collaborative planning than their secondary counterparts. Only 22% of all teachers reported opportunities to observe other educators during the implementation of PD initiatives (Wei et al., 2010).

Current research consistently states that student achievement gains are highly correlated with quality PD (Borko, 2004; Darling-Hammond, Wei, & Andree, 2010; Desimone, 2009; Smith, 2010; Yoon, Duncan, Lee, Scarloss, & Shapely, 2007, as cited in Stewart, 2014). Unfortunately, the correlation between quality PD and student achievement is not always a priority for schools when planning professional growth opportunities for educators. Exhaustive research studies have reported that many teachers in the United States feel much of their PD opportunities are not useful (Darling-Hammond, Wei, Andree, Richardson, & Orphanos, 2009). The focus of this Record of

Study (ROS) was to address a problem where there is a lack of quality PD for high school biology teachers at Middle Valley High School in Castroville, Texas. The purpose of Chapter I is to describe the context in which the ROS solution was applied and how the local context compared to the national epidemic where there is a lack of quality PD for secondary teachers.

Situation

The Middle Valley Independent School District (MVISD), located 20 miles west of San Antonio, Texas, was formed just over 50 years ago when the communities of Castroville and LaCoste merged their two independent school districts.

The lone high school in Middle Valley I.S.D.'s houses approximately 1,100 students. MVHS's populations mirror those of the district with a majority of the students reporting as Hispanic (51%) or White (45%) (Texas Education Agency [TEA], 2014). Although MVHS does not claim Title-I funding, the campus qualifies with over 45% of students listed as being economically disadvantaged. Approximately 32% of the students at MVHS are at-risk of dropping out of high school (TEA, 2014).

MVHS employs 63 teachers with the majority of its staff possessing between 6 and 20 years of experience according to the school's most recent Texas Academic Performance Report (TAPR). Less than 50% of the staff come from under-represented populations. TAPR reports that 21.5% of the teachers at MVHS are described as minority staff (TEA, 2014). For the purpose of this study, I focused on the science department, more specifically, the biology teachers.

My Involvement in the Situation

My Background

My professional background, relating to this study, included over 19 years in public education. I served five years as science teacher and another seven years as administrator at MVHS. Since moving from the classroom, I have served as the appraiser for the science and mathematics departments. In addition to overseeing instruction in mathematics and science, I serve as the campus designee for curriculum and assessment that includes working with teachers in regard to the implementation and alignment of the curriculum and administrative oversight for local and state assessments. I have been an active participant in, and current chairperson for, our campus-level decision-making committee for more than 10 years. I sit on the district-level decision-making committee. One of our primary missions on these two committees is to ensure alignment between our campus and district-level comprehensive needs assessments, improvement plans, and PD initiatives. My professional experience and current job description are directly aligned with this record of study where there is a lack of quality PD for secondary science teachers. For each of the last 10 years, I, along with our decision-making committee members, have worked to implement and evaluate PD initiatives at the campus and district levels.

My Field-Based Mentor

My field-based mentor, Mr. Neysmith (a pseudonym), is MVISD's Assistant Superintendent of Curriculum, Assessment, and Instruction. Mr. Neysmith was the principal at a national blue ribbon high school prior to joining MVISD more than seven

years ago. Mr. Neysmith serves as my district-level counterpart. Mr. Neysmith chairs the district-level decision-making committee that mirrors my responsibilities as the campus-level chairperson. Prior to the start of my internship, Mr. Neysmith and I met at least twice per month as part of our current job descriptions. Our working relationship includes the planning, implementation, and evaluation of all matters relating to curriculum, instruction, and assessment at MVISD.

Initial Understanding

My original framing of the problem was based on my personal experience working within the context of this particular study. I have served 12 years at MVHS: five as a teacher and seven as an administrator. I have 19 years of experience in secondary education all together. Additionally, I was influenced by the literature covered in my recent coursework at Texas A&M University.

Some of the most reoccurring attributes of quality PD, found in the literature, include ongoing, comprehensive, collaborative, content-specific, coherent, and connected to practice (Darling-Hammond et al., 2009). I used these attributes as an evaluation guide in my initial framing of the issue. In my personal experience, our school has primarily focused its PD efforts on generalized versus content-specific topics through a traditional sit-and-get/one-shot workshop setting. My original assumptions related to this approach were based on my experiences where secondary PD initiatives were complicated by a wide variety of subject areas that made providing ongoing content-specific training costly and time-consuming.

For example, the science department alone has over seven courses with specialized content spread among 10 teachers. Scheduling comprehensive, ongoing, and content-specific training is difficult enough without considering the last two attributes where quality PD is collaborative and connected to practice. These two attributes highlight the greatest obstacle, *time*. Providing ongoing collaborative training that is connected to the classroom setting requires teachers to be out of the classroom for significant amounts of time.

Relevant History of the Problem

The relevant history of the proposed problem of practice was explored through a series of field experiences as part of my internship with the school. During one of these experiences, several reconciliatory efforts that addressed PD deficiencies were identified. Mr. Klein (a pseudonym), MVHS science department chair, described an "exchange-day" district policy that allowed teachers to select PD opportunities outside their current contracted days. These PD opportunities were required to be aligned with both personal and school goals. The program provided opportunities for content-specific training. However, these opportunities were short in duration, lasting a maximum of two days, rarely included collaborative interactions between teachers, and were not directly connected to practice.

Ms. Cote (a pseudonym), a biology teacher at MVHS, described how the administration had adapted the school's bell schedule to allow for weekly collaborative planning between teachers. Each Collaborative Wednesday, teachers are provided time to meet on topics relating to curriculum, instruction, assessment, and mentoring. On the

positive side, Collaborative Wednesday provides ongoing, collaborative, content-specific interactions between educators. From a negative standpoint, teachers are straying from the original intent of "Collaborative Wednesdays." Teachers are trading collaborative meeting time to offer tutorials for students. Teachers argue that students are a priority they could not ignore.

Finally, Ms. Moreno (a pseudonym), the district curriculum coordinator, discussed recent efforts to provide not only face-to-face PD but also online trainings providing a more customized approach to PD. The initiative is facilitated through a new PD vendor called "PD 360." The program offers a catalog of PD courses; however, the offerings are rarely content-specific and possess a number of technology "bugs" that have caused significant levels of frustration among staff members.

Stakeholder Groups and Values

At my internship when I met with the participants, I shared my Record of Study (ROS) and Darling-Hammond et al.'s (2009) attributes of quality professional development. Without further group dialog on the ROS summary or Darling-Hammond et al.'s (2009) attributes of quality professional development, we scheduled follow-up interview sessions focused on capturing the essence of each of the participant's personal values for professional development. The participants included a 25-year veteran biology teacher and department chair (Mr. Klein), a second biology teacher entering year 5 of her career (Ms. Cote), a third biology teacher with no prior experience (Ms. Chase), and the district curriculum coordinator who has served over 15 years in the public school setting (Ms. Moreno).

Several common themes emerged at the group and individual interviews conducted during the internship. All participants found value in the idea of participating in content-specific professional development. Secondly, all participants were passionate about having time to implement quality professional development. Finally, all the participants agreed that quality professional development, by definition, was lacking at the school. Although many of the responses were related, each participant shared a particular interest in what was valued personally with regard to quality professional development.

Mr. Klein shared a surprising preference for collaborative professional development. Despite having over 25 years of experience, many of which were in a department leadership capacity, the department chair yearned for fresh ideas from new perspectives. Mr. Klein went as far as to say: “I have been doing this for more than 25 years and sometimes I wonder if I am doing it right.” Ms. Cote shared a couple of specific preferences related to the concept of quality professional development: (a) concern for a failure of teachers and administrators to show patience in implementing new initiatives when staff members were split on the perceived effectiveness of an initiative, administration would quickly move in another direction; (b) the need to drill down even further with regard to content-specific training; and (c) content-specific training should be focused on the particular needs of the students and not simply cover the subject in a general sense. Ms. Chase, the new teacher, expressed a desire to receive content-specific training that was focused on practical implementation. She felt well prepared from a content perspective but needed additional pedagogical support. Finally,

Ms. Moreno shared perspectives from the district level valuing sustainability that came from truly understanding the needs of individuals, matching those needs with the organization, and developing trusting professional learning communities where stakeholders are comfortable sharing their ideas.

Significant contrasting views were not reported, other than Mr. Klein's preference to start *big* and overhaul our entire approach to professional development versus Ms. Cote's desire to start *small* and allow new approaches to permeate throughout the school. My personal preferences are aligned with the latter.

Problem of Practice

Learning More

In learning more about the problem situation, I originally framed the problem situation within the context of my personal experience working with the science teachers and administrators at MVHS. Additionally, I used a common set of attributes for quality PD that helped to shape my understanding of the problem. Attributes for quality PD suggest that it should be ongoing, comprehensive, collaborative, content-specific, coherent, and connected to practice (Darling-Hammond et al., 2009). In my original framing of the problem, I found PD at MVHS to be generalized one-shot sit-and-get trainings for the masses. Although current offerings failed to share the attributes of quality PD, several reconciliatory efforts had been made to address the problem including:

- offering teachers the opportunity to attend personalized PD trainings in the summer in "exchange" for generalized trainings during the school year;

- implementing a weekly "Collaborative Wednesday" common planning schedule for teachers to address curriculum, instruction, and assessment issues; and
- purchasing the "PD 360" online PD service that provides educators with a catalog of titles for professional growth.

Unfortunately, weaknesses in the areas of coherence with school goals and failure to implement the initiatives with fidelity have hindered these attempts to address deficiencies in PD offerings at MVHS. I conducted one-on-one interviews with the three biology teachers to capture the essence of the teachers' values with regard to the problem. I used Cuban's (2001) method for identifying participant values as they relate to the identified problem. The participants held professional and organizational values in the highest regard. Teachers and administrators agreed the school should commit to providing content-specific PD. Individually, the participants called for stronger commitments from teachers and administrators, greater coherence between personal and organizational goals, and a genuinely collaborative effort to improve instruction rather than a focus on administrative oversight.

Professional value: Obligation to clients. Ms. Cote valued strong administrative support for PD. Her concern was for a lack of commitment in seeing PD initiatives through. She mentioned a possible cause for a lack of commitment might include the one-shot workshop approach with a failure to follow up or follow through. Ms. Cote valued PD that is not only content-specific but targeted specifically to meet the

students' critical need areas: "What I really want are ideas on how to reach the students in a better way."

Professional value: A need for autonomy. Ms. Chase discussed the need for content-specific PD. Ms. Chase reflected on her recent college-level teacher preparation courses, saying:

> I had to fill out these extremely long lesson plans. They were a lot longer and more detailed than what I am doing on the job; however, there was little preparation on how to implement those plans. I find now that I'm learning more about implementation of the actual lesson versus theoretical planning. I felt that there is a disconnect between what I was doing in college and what I am doing now.

She felt the preparation program was very detailed in the area of lesson planning; however, the process did not adequately prepare her for implementing the plans in a live classroom. Ms. Chase felt it was important to replicate the learning environment in a more authentic manner versus a traditional theoretical-based approach.

Organizational value: Effectiveness. Ms. Moreno provided a district-level administrative perspective. Ms. Moreno focused her responses toward coherence between personal and organizational PD goals. She felt that coherence was a gateway toward sustainability, motivation, and commitment on the part of all stakeholders. Ms. Moreno valued a mixed-methods approach to provide online, face-to-face, and practical implementation to meet the individual and collective needs of the school. She felt the key to reaching these goals was to promote open and honest dialogue through

comprehensive needs assessments that are gathered through a culture of trust and honesty.

Social and political values: Participation. Mr. Klein discussed how current PD trends are geared toward administrative oversight and not for instructional improvement. He reflected on an experience where educators from surrounding districts gathered at the local regional educational service center to develop exemplar lesson plans focused on classroom instruction. Mr. Klein valued collaborative approaches to improving instruction.

After accounting for the values of each of the stakeholders against the backdrop of Cuban's (2001) classification categories, I considered whether the proposed problem of practice was simply a problem or a more complex dilemma for the purposes of this study.

Problem or Dilemma

Cuban (2001) described two types of organizational challenges: (a) tame problems that are routine and usually solved through the application of existing procedures and (b) ill-defined, wicked dilemmas that cannot be solved due to conflicting values within an organization. To clarify, dilemmas are not solved but are addressed through compromise or trade-off between stakeholders (Cuban, 2001). The challenge of providing quality PD at the secondary level has indications of being a true dilemma. Participants in recent interviews pointed toward conflicts between professional values and time constraints where teachers are pulled away from the classroom in order to participate in ongoing PD, which is connected to practice. From individual perspectives,

stakeholders identified several other conflicts that might contribute to the identified dilemma: competing PD initiatives with regard to funding, concerns for validity within the PD comprehensive needs assessment, connecting theory to practice, and the need for a stronger commitment to existing PD initiatives.

My Journey in the Problem Space

Considering alternative viewpoints. Although all participants consistently valued addressing the problem from an organizational perspective that provided support, guidance, and resources for implementing quality PD, we attempted to reframe the problem using an alternative perspective in order to view the problem from multiple viewpoints. Mr. Klein expressed a desire to shift the focus from authoritarian administrative perspectives that simply evaluate teachers toward a more facilitative approach to improving instruction. This idea fits with Cuban's (2001) political frame that points to imbalances in power as a potential cause to problems. Ms. Cote shared a scenario where imbalances in power are not always between administration and teachers. Ms. Cote described how she perceived that vocal minorities of veteran teachers sometimes use their influence to derail certain PD initiatives that fall outside the experienced educator's comfort zone. Ms. Cote felt that several potentially beneficial technology-related initiatives had fallen victim to bias and political influence. Once imbalances in power are recognized, the question becomes: "Who has the power to change them?" In this case, I would have influence as an instructional leader and researcher. This finding amplifies the importance of teacher voice in the construction of the problem solution.

The evolution of my current understanding. The evolution of understanding the problem for this study has filtered through two frames of reference. First, we considered the organizational frame where participants valued coherence between personal and organizational goals and the resources needed to ensure the success of the PD initiative. Secondly, we must create learning communities that guarantee that all participants have a voice in the problem-solution process. In other words, our mission was to collaboratively design and fully support a viable solution to the problem where there was a lack of quality PD for secondary science teachers.

Problem Statement

Ideal scenario/vision. The MVHS teachers and administrators have shared a vision for the ideal professional learning community. There is unanimous support for a new approach to PD focused on collaborative content-specific training. Additional shared qualities for quality PD include content-specific training with the following characteristics:

- data-driven and focused on student needs,
- collaborative and conducive to producing fresh ideas,
- facilitated by experts in the field,
- connected to practice, and
- coherent with personal and organizational goals.

Unfortunately, the current sets of circumstances are not congruent with the collective idealistic values expressed by both MVHS teachers and administrators.

The real. Teachers and administrators at the district and campus levels identified five obstacles preventing an ideal PD system including:

- time constraints,
- overreliance on generalized PD for the masses,
- a lack of commitment by some teachers and administrators,
- diluted and incoherent approaches, and
- misuse of collaborative planning time.

District-level administrators argue that generalized current PD offerings are relevant and sometimes mandated by federal and state guidelines. Teachers, on the other hand, feel that vocal minorities of educators have compelled administrators to prematurely abandon potentially successful PD initiatives. Teachers and administrators at all levels agree that much of the required PD is not aligned with the content-specific needs of the teachers. Finally, teachers blame themselves for moving away from the original intent of a weekly collaboration schedule in favor of providing additional tutoring for students.

Audience. This ROS is directed toward the teachers at Middle Valley High School (MVHS) who represent the primary stakeholders within the local context. After careful consideration of the participating MVHS stakeholders' values and perspectives relating to quality PD, the participants in this study collaboratively chose to explore the Japanese originating Lesson Study Professional Development (LS PD) model as a potential solution to the proposed problem of practice where there is a lack of quality PD for secondary biology teachers. The hope was that MVHS teachers would eventually choose to sustain the LS PD model. Together, we designed and implemented a form of

LS during the 2014–2015 school years, which met the needs of the primary stakeholders. In order to build a sustainable PD model, I addressed the idealistic values that frontline teachers feel are most critical in building a professional learning community. Additionally, I sparked the interest of campus and district-level administrators who provided support and resources for effective intervention initiatives. The goal was to collaboratively develop a well-supported and manageable study, beginning with the biology teachers at MVHS. Meaningful results should enable the LS PD model to permeate throughout the school and, hopefully, extend into other schools in the district and region.

Consequences for the audience. Unless the school changes its current mode of delivery type for PD, teachers will continue to suffer the consequences. Failure to implement collaborative content-specific training will allow experienced educators to become stagnant and force novice teachers to learn through trial and error, which may negatively impact student learning (Marble, 2006). Successful implementation of LS PD will hopefully result in a highly sustainable learning community of practice.

My role. I assumed a participant-as-observer role in which the participants were aware of my identity as a researcher. I participated at a significantly high level of involvement during the LS PD initiative (Hesse-Biber & Leavy, 2011). My role in the study was to facilitate the collaborative design and implementation of a quality PD model that met the specific needs for the current contextual learning environment at MVHS. I provided participants with information from the research literature that informed the group of current best practices in the area of quality PD. Additionally, I

worked closely with the MVHS biology teachers and school administrators during group meetings and one-on-one discussions focused on understanding and incorporating their collective values for implementing a quality PD initiative. I chose the participant-as-observer role as it allowed some flexibility in the level of involvement during the study. Although I have gained a deeper understanding of the participants' perceptions as a complete participant, the participant-as-observer role allowed me to distance myself during interviews in an effort to avoid overstating my feelings toward the LS PD initiative (Hesse-Biber & Leavy, 2011).

CHAPTER II

LITERATURE REVIEW

Theories

Lesson Study (LS) is a form of PD that originated in Japan (Mutch-Jones, Puttick, & Minner, 2012). Although LS has been implemented in many different settings, the theoretical core remains constant. In its simplest form, LS has been described as a cycle where teachers collaboratively plan, observe, and discuss research lessons (Loucks-Horsley, Stiles, Mundry, Love, & Hewson, 2009). Other researchers have defined the LS process as a more complex process where educators collaboratively:

1. define a problem through data analysis,
2. research and plan a lesson using books and articles produced by other teachers,
3. teach the lesson along with peer observations,
4. collaboratively evaluate, reflect, and critique the lesson,
5. revise the lesson,
6. teach the revised lesson to a second group of students with invited guests,
7. evaluate and reflect again, and
8. share results in a written report. (Fai Pang, 2006; Stigler & Hiebert, 2009)

One of the goals of LS is to create a culture of collaboration focused on improving student learning while promoting individual and social learning among educators (Chassels & Melville, 2009). LS PD addresses both the social side of adult

learning through collaborative interactions as well as the participants' classroom-specific needs. LS has been credited with providing many professional growth opportunities for teachers in the areas of improving content knowledge, refining instructional practices, developing stronger collegial networks, and increased levels of motivation (Lim, Lee, Saito, & Syed Haron, 2011). The focus of LS is often misunderstood. Despite the title, LS, the primary focus of the initiative is not to produce lessons but instead open "windows into each other's classrooms that we need to improve instruction" (Lewis & Hurd, 2011, p. 14). LS PD takes a clinical approach to improving instruction. LS has been described as experimental or situated learning, "taking place within the same context in which it is applied" (Suh & Fulginiti, 2012, p. 25). LS PD has suggested that elements of quality instruction can be developed simultaneously, versus addressing them as isolated parts. The LS process has been described as a study of the interplay between student learning, student thinking, curriculum, and pedagogy (Stigler & Hiebert, 2009).

Lesson Study is viewed as a collaborative form of PD. Research has recommended that LS groups not include more than five to six teachers per group (Fernandez, 2002). These intimate professional learning groups allow for full participation. Organizations seeking to implement LS should invest a significant amount of time developing organizational protocols that allow participants to serve multiple roles such as recorder, teacher, and observer while also establishing group norms such as valuing everyone's opinions and expecting full participation from all group members (Perry & Lewis, 2009). LS is a purpose driven model that seeks to address specific learning objectives. At the onset of the process, groups develop learning goals that guide

the development of research lessons based on local assessment data (Suh, & Fulginiti, 2012). Participants may also review student products such as journals, worksheets, or portfolios when conducting background information for the lesson. Once lesson goals are created, group participants, or external content experts, design the lesson around potentially difficult concepts that may challenge student thinking (Hart, 2009). LS goes beyond theoretical lesson design where activities are designed and disseminated without opportunities for authentic implementation. During the teaching and observing phases, the participants look for misconceptions that may or may not have been predicted during the planning phase (Fai Pang, 2006). LS allows educators to not only develop a theoretical background knowledge of best practices, but it also provides educators with opportunity to implement what they have learned. According to research, student achievement is positively impacted when teacher PD allows educators to implement skills acquired in trainings (Joyce & Showers, 2002). Live observations allow participants to identify complex learning misconceptions as well as the logistics of leading a highly productive classroom.

Other noted observations may include student engagement, student attitudes toward learning, the degree of student-to-student interaction, and/or success of the instructional strategy; however, researchers have also shown a preference for allowing the observers to design their own observation tool (Kolenda, 2007). Debriefing, evaluating, and critiquing sessions should come immediately after the lesson presentation is completed for clarification purposes. Misconceptions and strategies to address potential misunderstandings should be embedded in the lesson prior to the

second presentation. The individual lessons as well as the final study report should contain sufficient details allowing for replication including plans, materials, rationale, potential obstacles, data analysis, and concluding remarks (Cerbin & Kopp, 2006).

There are a number of LS assumptions to consider when seeking to gain a better understanding of the process:

- LS is more focused on teacher learning than student learning.
- LS success is dependent on quality peer observation opportunities and subsequent reflective discussion focused on student thinking.
- LS should be facilitated by outside-the-school experts, draw on historical data, and review outside curriculum sources.
- The phases/stages of LS are integrated and equally balanced in value.
- There is a need to scale-up LS initiatives to include cross-site sharing or disseminating ideas (Lewis, Perry, Hurd, & O'Connell, 2006).

LS is a professional development model that leads potential participants to believe that it is strictly focused on adult learning. Although it is assumed that LS focuses primarily on teacher learning, student learning can be viewed as a complementary goal in the process where students benefit from improvements made to the lesson during the collaborative teaching, observing, evaluating, critiquing, and re-teaching the lesson (Marble, 2006). LS is a targeted process that takes an investigative approach to improving instruction and student outcomes. This purposeful look at student learning is centered on a research lesson designed to investigate how students think through the lesson (Lewis, Perry, Friedkin, & Roth, 2012).

Relevant Literature

The preceding section focused on the traditional attributes of the LS model. There is a significant amount of literature that warns against taking a one-size-fits-all approach to implementing LS (Lewis, Perry, & Murata, 2006; Perry & Lewis, 2009). LS allows schools to develop a customized approach to improving instruction. Although LS implementers adhere to the general principles of the cycle, one of the key attributes of LS is its ability to be adapted to fit the specific needs of an organization within the local context (Lewis, Perry, & Murata, 2006; Perry & Lewis, 2009). Although LS can be customized to meet the needs within a local context, participants must be prepared to overcome some constraints. One of the most significant barriers mentioned in the literature to overcome and adapt to was the time required for LS (Lewis, Perry, Hurd, & O'Connell, 2006; Lim et al., 2011). LS's multi-phased process called for teachers to miss a significant amount of time of class time.

Moreover, time constraints came from non-LS related issues. More specifically, constraints stemming from other mismatched initiatives that competed for limited time commitments from stakeholders (Lim et al., 2011). In addition to added time constraints, this lack of coherence between initiatives may lead to undue stress on participants. Schools have elected to adapt LS timelines to fit their needs resulting in a more productive form of the initiative versus simply adopting a traditional published script for implementation (Perry & Lewis, 2009). Instructional leaders are well-served in considering the unique scheduling needs of each LS PD team.

Finally, high levels of coherence between PD initiatives, teacher goals, and school goals were critical to addressing potential time constraints (Penuel, Fishman, Yamaguchi, & Gallagher, 2007). In addition to timeline adaptations, there are other relevant areas for adapting LS in the literature. Because LS impacted the culture of teaching, which learned from itself, experts suggested implementing LS on a small scale and allowing it to spread and expand throughout the school (Hiebert & Stigler, 2000). Starting small and scaling-up the initiative may result in a well-supported initiative that will more readily permeate throughout the school. Researchers looking to add depth in exploring curriculum and pedagogical best practices were advised "either to focus resources on fewer teachers or to invest sufficient resources so that more teachers can benefit from high-quality professional development" (Garet, Porter, Desimone, Birman, & Yoon, 2001, p. 935).

Significance of the Literature Review

The significance of the literature review was its role in framing the problem: a lack of quality PD for secondary science teachers. The initial framing of the problem came from exhaustive research that reported that PD in the United States failed to provide collaborative, content-specific training that was connected to practice (Wei et al., 2010). The literature provided a theoretical framework for addressing the problem through implementing LS, the Japanese originating PD model. The generic eight step traditional LS approach was outlined in Lewis and Hurd's (2011) book titled *Lesson Study Step by Step: How Teacher Learning Communities Improve Instruction.* The accompanying DVD provided me with a video diary of how each phase of LS is

implemented. Lewis and Hurd (2011) provided the most relevant and detailed information for implementing the LS PD process including specific guidance documents for the following areas:

- assigning participant roles,
- developing group norms,
- choosing a research theme,
- developing long- and short-term goals,
- generating a lesson rationale or justification based on data,
- a vertical study of the curriculum for future and prior learning alignment,
- collaboratively redesigning a lesson based on research by: proactively exploring potential student misconceptions and teacher responses and establishing points to notice during the observation phase of LS,
- collaboratively reflecting on and redesigning the lesson after the initial teach,
- implementing changes during a second teach, and
- completing a final reflection report exploring the lessons learned throughout the process.

CHAPTER III

METHODS AND RESULTS

The Choice of a Solution

Two potential solutions to the proposed problem of practice, where there is a lack of quality professional development for secondary biology teachers, emerged through the exploration of the problem space, stakeholder values, and a review of the literature. Relevant stakeholders reviewed the two proposed solutions and put forth proposed solutions.

Solution 1

The current identified problem was a lack of quality PD characterized as collaborative, ongoing, content-specific, and connected to practice. One possible solution was to implement a *traditional* form of LS that included the following eight steps:

1. defining a problem through data analysis;
2. *researching and planning a lesson* using books and articles produced by other teachers;
3. teaching the lesson along with peer observations;
4. collaboratively evaluating, reflecting, and critiquing the lesson;
5. revising the lesson;
6. teaching the revised lesson to a second group of students with invited guests;
7. evaluating and reflecting again; and

8. sharing the results in a written report.

The preceding steps would be implemented in three cycles. Favorable outcomes may include increased levels of teacher self-efficacy, content knowledge, and pedagogical proficiencies. Data collection methods would include teacher reflection journals, open-ended teacher interviews, and discussion group interviews. These data collection methods could be conducted before, during, and after the initiative was completed. Additional analysis would come from a review of LS process documents.

Solution 2

Considering the current identified problem was a lack of quality PD characterized as collaborative, ongoing, content-specific, and connected to practice, another possible solution was to implement a *modified* form of LS that included the following steps:

1. defining a problem through data analysis;
2. *implementing a lesson developed by content experts that is connected to current organizational PD initiatives* (The participants are currently participating in expert-led content-specific training facilitated by our regional service center)*;*
3. teaching the lesson along with peer observations;
4. collaboratively evaluating, reflecting, critiquing, *and revising the lesson* (We combined steps 4 & 5 from above);
5. teaching the revised lesson to a second group of students;
6. evaluating and reflecting again; and

7. *presenting the results at a district-wide meeting* (presentation versus written report).

The preceding steps would be implemented in three cycles. Favorable outcomes would include *increased levels of student achievement*, teacher self-efficacy, teacher content knowledge, and pedagogical proficiencies as reported by teachers. Data collection methods could include teacher reflection journals, open-ended teacher interviews, and discussion group interviews. These data collection methods would be conducted before, during, and after the initiative would have been completed. Additional analysis could come from a review of LS process documents.

Input from Others

Input in this section was comprised of feedback received from the three biology teachers in the study: (a) my field supervisor and an expert in LS. Mr. Klein (a pseudonym) is the science department chair with over 25 years of experience; (b) Ms. Cote (a pseudonym) has four years of teaching experience; and (c) Ms. Chase (a pseudonym) is a first-year teacher. My field supervisor, Mr. Neysmith (a pseudonym), is the Assistant Superintendent of Curriculum, Instruction, and Assessment at the Middle Valley Independent School District. Mr. Neysmith is the former principal of a nationally recognized *Blue Ribbon* high school with over 30 years of experience in education. Final input came from Dr. Connie Young (a pseudonym), who was a professor at a state university in the Southern United States. Dr. Young is an expert in the field with over 10 years of study in the area of LS PD. Dr. Young currently teaches a course in LS at the university.

Stakeholders' Input

All three teacher participants chose problem solution 2 with slight changes and points of clarification. The group unanimously agreed that step 2, incorporating current district PD versus researching materials, was a more efficient and targeted approach to implementing LS. Ms. Cote stated: "When looking at researching lessons, just researching and planning lessons using a book or articles . . . that would be just too time-consuming." Ms. Cote also reinforced the idea of using pre- and post-tests during each of the three agreed upon LS cycles. Mr. Klein asked that we video portions of the process for dissemination purposes. Ms. Chase agreed with the dissemination process outlined in solution 2, but asked for a team presentation.

Classmates' Input

Input from my classmates revealed support for proposed solution 2. The nature of their comments focused on clarifying and providing greater specificity in the proposal. Supporting comments included a preference for participants to connect current PD initiatives and organizational goals with the new LS proposal as outlined in step 2. My classmates mentioned how this approach would work best considering the time constraints many schools face. In other words, coherence between current organizational goals and the LS proposal would facilitate a more focused effort. Additionally, classmates supported the idea of disseminating results in the form of a year-end presentation to include teachers in the district. Suggestions for clarification included a need to justify the increased number of lesson deliveries in step 7 and to incorporate more information on how dissemination would lead to the sustainment of the initiative.

The previously mentioned feedback supported our collaborative efforts in refining solution 2 to include greater specificity in the proposal.

Field Advisor's Input

Mr. Neysmith was not opposed to either of the two proposed solutions. Mr. Neysmith was partial to solution 2 for its coherence to existing district goals as well as for the second proposal's approach to disseminating results in a presentation format. He explained how presentations allowed for face-to-face interactions and opportunities for dialogue that cannot be equally matched by written reports. With regard to refining solution 2, Mr. Neysmith called for an emphasis on student achievement scores specifying that the audience included high school teachers, middle school science educators, and elementary science teachers who may want to participate in the final dissemination presentation. This revelation hinting at teachers volunteering to participate in the final dissemination presentation was congruent with research where LS PD should be teacher-driven.

Others' Input

Dr. Young supported a traditional approach to implementing LS as represented in problem solution 1. Although her recommendations run counter to all other participants interviewed, several key suggestions helped to reshape the final proposed solution. Dr. Young echoed the sentiments of others by focusing on continuously harvesting data throughout the process. She stressed the need to develop an observational tool that focused on student learning behaviors versus teacher behaviors during lesson presentations. Dr. Young also suggested several orientation tools that might help the

participants gain an understanding of how the basic LS process worked. As a result of these recommendations, I decided to collaboratively review the orientation resources, including videos of the process, with our biology teacher participants. These materials are included in a manual titled *Lesson Study Step by Step: How Teacher Learning Communities Improve Instruction* by Catherine C. Lewis and Jaqueline Hurd (2011). These materials informed our collective understanding of LS and guided our efforts in designing data collection tools.

The Proposed Solution

As a result of the preceding data collection activities, our collaborative efforts focused on moving forward on the collective recommendations of the stakeholders. Revisions to the LS proposal included an informed LS orientation, a collaborative approach to designing ongoing data collection tools that were focused on student learning/achievement along with teacher perceptions of the process, and a refined final dissemination process that included invitations for all grade-level science teachers. These invitations were in addition to final dissemination invitations to all high school teachers regardless of content area or grade level. We built off proposed solution 2, as preferred by the biology teacher participants, in an effort to promote coherence with current organizational goals. Implications for this approach resulted in a locally adapted form of LS that met the needs of its participants while promoting coherence and efficiency, allowing future replications of the process to flourish.

The Final Solution

Upon reflection, I found that my participants were in support of problem solution 2 with minor modifications. More importantly, the collaborative efforts to develop a viable solution provided ongoing and content-specific PD that was connected to practice. The preferred LS solution among participants was one that was customized and coherent with local organizational goals providing ongoing data collection focused on student learning and a dissemination process that promoted sustainability among teachers within and outside of the biology content area. These adaptations appeared to mesh well with proposal number 2. Favorable outcomes included increased levels in pedagogical proficiencies as reported by teachers and a sustainable professional learning community measured by the audiences' interest in continuing the LS process. Data collection methods included teacher reflection journals, open-ended teacher interviews, and discussion group interviews. These data collection methods were conducted before, during, and after the initiative was completed. Additional analysis came from a review of LS process documents.

Guiding Questions

The guiding or *research* questions for this record of study (see Table 1) were aimed at discovering the perceptions of the biology teacher participants with regard to the value and sustainability of LS PD as a viable solution to the problem where there was a lack of quality PD for secondary biology teachers. Question 1 was connected to exploration of the value of the LS PD initiative as it related to our first research goal of assessing the value of the LS model as a viable solution to a lack of quality professional

development for secondary biology teachers. Question 2 explored the possible professional growth experienced by participants who correlated with research goal 2, seeking to provide participants with ongoing PD growth opportunities. Question 3 looked to gauge the levels of interest among the audience for replicating and sustaining the LS PD initiative, and question 4 asked how we might further improve on the locally adapted LS PD model that was congruent with research goal number 3.

Procedures

Goals, Objectives, and Activities

The following goals, objectives, and activities (see Table 2) were interconnected with the purpose of outlining the specific inputs (activities) that ultimately produced a locally designed LS PD model capable of addressing the posed problem of a lack of quality PD for secondary biology teachers. My hope was to capture the biology teachers' perceptions toward LS as a potentially viable solution to a lack of quality professional development and discover areas of professional growth among the participants and explore the possibility of designing a sustainable model within the local context.

Table 1

Goals, Objectives, Activities, and Guiding Questions

Goal	Objective	Activity
I. All biology teachers will assess the value of the Lesson Study (LS) Professional Development (PD) process. Guiding Question: What are the perceptions of the participants about the viability of LS as a solution to the lack of quality PD for secondary biology teachers?	A. All biology teachers will participate in a book study, video study, and orientation to the LS process B. All biology teachers will teach and critique at least three lessons using the LS process.	1. Provided copies and associated LS videos from *Lesson Study Step by Step: How Teacher Learning Communities Improve Instruction* (Lewis & Hurd, 2011). 2. All biology teachers participated in three LS orientation sessions focused on: The book study, a video review of the LS process, and collaboratively construct group norms associated with the LS process. 3. Three lesson cycles were completed that allowed all three biology educators to teach and observe the LS PD process (Spring 2015).
II. All biology teachers will report professional growth throughout the LS PD process. Guiding Question: What are the perceptions of the participants in regard to their own professional growth as a result of participating in the LS initiative?	A. Teachers will report increased levels of content-specific proficiencies during the LS PD process. B. Teachers will report increased levels of pedagogical proficiencies during the LS PD process.	1. Teachers completed two lesson observations during each of the LS cycles. 2. Teachers completed reflection journals during each of the three LS cycles. 3. Teachers participated in discussion group meetings and individual interview sessions during each of the three LS cycles.
III. Biology teachers will develop a sustainable form of LS that can be replicated within the local context. Guiding Questions: What improvements to the LS PD model might facilitate future implementation? What are the perceptions of the LS dissemination audience toward LS as a viable solution to a lack of quality PD for secondary biology teachers?	A. Biology teachers will produce three exemplar lessons at the conclusion of the LS initiative. B. LS dissemination audiences will report interest in replicating the LS process.	1. Biology teachers created three exemplar lesson plans derived from district-driven content specific PD trainings/materials. 2. Dissemination presentation audiences completed a final dissemination presentation questionnaire focused on replication and sustainment probabilities.

Table 2

Goals, Objectives, and Activities Associated with the Problem Solution

Goal	Objective	Activity
I. All biology teachers will assess the value of the Lesson Study (LS) Professional Development (PD) Process.	A. All biology teachers will participate in a book study, video study, and orientation to the LS process	1. Provided copies of the book and associated LS videos from *Lesson Study Step by Step: How Teacher Learning Communities Improve Instruction* (Lewis & Hurd, 2011).
	B. All biology teachers will teach at least three lessons using the LS process.	2. All biology teachers participated in three LS orientation sessions focused on: The book study, a video review of the LS process, and collaboratively construct group norms associated with the LS process. 3. Scheduled three lesson cycles during which all three biology educators taught and observed the LS PD process. Data gathering: Participants completed personal reflection journals after each LS cycle. I conducted individual interviews and discussion group interviews with participants at the conclusion of each of the LS Cycles.
II. All biology teachers will report professional growth throughout the LS PD process.	A. Teachers will report increased levels of content-specific proficiencies during the LS PD process.	1. Teachers completed two lesson observations during each of the LS cycles. 2. Teachers completed reflection journals during each of the three LS cycles. 3. Teachers participated in discussion group meetings and individual interview sessions during each of the three LS cycles.
	B. Teachers will report increased levels of pedagogical proficiencies during the LS PD process.	Data gathering: The biology teachers participated in discussion group interviews and completed personal reflection journals after each LS cycle. I conducted individual interviews and discussion group interviews with participants at the conclusion of each of the LS Cycles.
III. Biology teachers will develop a sustainable form of LS that can be replicated within the local context.	A. Biology teachers will produce three exemplar lessons at the conclusion of the LS initiative.	1. Biology teachers created three exemplar lesson plans derived from district-driven content specific PD trainings/materials.
	B. LS dissemination audiences will report interest in replicating the LS process.	2. Participants created a dissemination presentation for staff members. Data gathering: Dissemination audiences completed a final dissemination presentation questionnaire focused on replication and sustainment probabilities.

Timeline

The problem solution meeting, presentation of the proposed ROS, and preliminary discussions for implementation occurred in the fall semester 2014. The full LS PD initiative began with a one-week book study of the LS process provided through Lewis and Hurd's (2011), *Lesson Study Step by Step: How Teacher Learning Communities Improve Instruction*. The LS PD biology teachers then participated in a two-day orientation covering roles, group norms, LS PD process videos, long-term goals, and timelines. After completing the orientation, the biology teachers completed three full cycles of the LS PD process using Lewis and Hurd's (2011) guiding documents (see Appendix A) followed by a dissemination presentation.

Cycle 1. During the first week of March 2014, participants met as part of a two-hour Collaborative Wednesday schedule that is held each week as part of the school's regular planning time for teachers. During this first session, participants established group norms and roles. Group-adopted norms included being open-minded, having a positive and supportive attitude, focusing on the students, listening to all ideas before reacting, and staying on task. Group member roles included: project facilitator, note taker/typist, and teacher. For cycle 1, Mr. Klein served as teacher for the first presentation, Ms. Cote served as the teacher for the second lesson presentation in the cycle, and Ms. Chase served as the note taker/typist. I served as the group's project facilitator throughout each of the three cycles. The project facilitator was charged with organizing the initiative by scheduling meetings and activities, providing logistical

supports such as substitute teacher coverage, and serving as the LS PD expert who guided the group through the entire process (Lewis & Hurd, 2011).

During a half-day orientation session on day 2, the group viewed a video that accompanied the book study materials for *Lesson Study Step by Step: How Teacher Learning Communities Improve Instruction* by Lewis and Hurd (2011). The video covered protocols for studying and planning for a lesson study, the first teach of a lesson study, the first post-lesson discussion after the first teach, the second teach, the second post-lesson discussion, and a final reflection for the cycle. After each section of the video was viewed, participants reflected on the topic as it was covered in the book study.

The LS PD team met the next day for an additional half-day orientation session. The facilitator reviewed the remaining chapters of the book study not covered in the previous day's video review of the LS process. Discussion topics included what to expect from lesson study in the way of personal growth through analyzing student thinking and exploring content collaboratively; an overview of the types of lesson study beginning with small groups of no more than six participants to large-scale initiatives such as school-wide implementation; and finally, dispelling some of the myths and misconceptions about lesson study as a professional development model. Some of the common misconceptions included (a) Lesson Study was not simply planning lessons, but developing instructional proficiencies over time; (b) Lesson Study was not original work, but the adaptation of existing lessons to meet the needs of students in the local context; and (c) Lesson Study was not applied only to exemplar lessons, but beneficial for improving everyday lessons that focus on topics of interest or need (Lewis & Hurd,

2011). Day three concluded with a homework assignment to bring all potential lesson materials including books, the Texas Essential Knowledge and Skills, lesson plans, student work, and student data.

On Monday of the following week, participants met for a full day that began with establishing a long-term goal for their lesson study: students will think critically using information to solve problems and draw conclusions. This long-term goal would remain constant through all three LS cycles. The team began to comb through performance data and other lesson preparation materials for the purpose of selecting a lesson for cycle 1. After reviewing performance data and student work, the team selected a lesson requiring students to identify the anatomy of DNA and describe how traits are carried within an organism's DNA. Additionally, students would need to be able to identify the parts of DNA that make up the genetic code in living organisms (TEA, 2015). The participants documented specific details uncovered during their research on student performance including that students persistently found the concept of building a polymer using monomers difficult and that specific content related to the DNA structure needed to be addressed, including base pair rules location of the code, and recognition of the arrangement of the nucleotide within DNA.

In addition to the performance assessment data, the team visited the state's TEKS Resource System website and discovered that the identified teaching standard was classified as a prioritized *readiness standard*. It was important to note that the TEKS curriculum comprised both readiness and supporting standards. Supporting standards are an important component of the state's curriculum; however, readiness standards have

been designated as critical learning objectives making up the majority of the State of Texas' Assessment of Academic Readiness (STAAR) test (TEA, n.d.). Based on this rationale, the teachers selected a lesson that targeted the identified deficiencies. The lesson was provided to the participants during a professional development session at the local Region 20 Education Service Center. The Lesson Study process does not call for participants to completely design a lesson, but to modify or adapt an existing lesson that addresses student performance deficiencies, teacher deficiencies, or piques the professional development interests of the participants (Lewis & Hurd, 2011).

The participants then set out on meticulously redesigning the lesson to specifically address deficiencies and concerns identified in the research process. Participants first outlined specific lesson goals based on specific information in their research. The team collaboratively discussed which areas of the lesson might be difficult for students to learn or for educators to teach. They considered specific behaviors that they have observed in the past when presenting the content. Participants identified perceived strengths they felt the students were able to exhibit in previous years' lessons. The team discussed and documented a specific set of vocabulary to be mastered during the lesson.

Next, the team reviewed student learning objectives at grades 6 and 7 that correlated with the current targeted learning objectives as part of a vertical alignment review. One of the most important proactive planning strategies for LS is the ability to anticipate student responses and misconceptions (Suh & Fulginiti, 2012). The LS team spent a significant amount of time attempting to anticipate student responses to the

presented material and visited the instructional focus documents on the state's TEKS Resource System with the goal of identifying potential learning barriers and misconceptions. At the conclusion of the preplanning stages of Lesson Study, the teachers prepared to adjust or redesigned the existing lesson to address the specific needs of their students. The LS PD group adjourned for spring break.

On the Monday following spring break, the team assembled for a full day committed to the lesson design phase of the LS PD model. According to Lewis and Hurd (2011), the lesson design should include sections detailing student learning activities, anticipated student and teacher responses, and specific points to notice during the observation phases of the LS process. Additionally, lessons should be designed to promote active student interaction and dialogue from which observers can draw conclusions about student learning (Lewis & Hurd, 2011). During this full-day session, the LS team purposefully redesigned the lesson into four phases maximizing student outputs. The lesson was designed to begin with an introduction that included a self-reflective warm-up question followed by an opportunity to share their reflections in small lab group settings. A two-part laboratory activity began with students working collaboratively with their lab partners using manipulatives to construct monomers and polymers.

Part 1 of the laboratory activity required students to respond to short answer questions focusing on the properties of monomers. Part 2 of the laboratory activity required that the smaller laboratory groups of two or three join a second group of students in order to combine their manipulatives and construct a polymer. Part 2 of the

laboratory activity required students to collaboratively answer seven additional short answer questions regarding the properties of polymers. According to Cain and Laird (2011), opportunities for writing in the content areas were often overlooked due to teacher misconception that writing must be extended to multiple pages of text. This idea may discourage teachers from implementing writing activities outside the English Language Arts classroom. Writing in the content area has been productive when students were provided opportunities to simply take notes, compare and contrast information, or summarize (Cain & Laird, 2011). The fourth and final phase of the lesson required students to summarize their learning with regard to monomers, polymers, nucleotides, and DNA.

After completing the lesson design process, participants focused their efforts on anticipating student and teacher responses based on an earlier analysis of potential learning barriers and misconceptions that may arise during the lesson. The teachers identified 13 areas where students may pose questions or otherwise benefit from reinforcement. The majority of these anticipated responses focused on vocabulary. The LS team finalized the lesson design by identifying eight areas of *points to notice* during the observation stage of the LS PD process.

The *points to notice* or *data collection points* were broken down into two categories. The first category was established for observers who possessed content-specific expertise in biology. Four data collection points were identified for content-specific observers to evaluate. Content expert observers, which included Ms. Cote and Ms. Chase, were charged with evaluating these content-specific points to notice during

the first teach. The second category of points to notice were less content-specific and more so based on best practices in pedagogy and logistics. The final activity for this full day of planning consisted of a practice run-through of the lesson to ensure all participants understood and agreed that the activity was ready for presentation.

On Tuesday morning, the LS PD team reconvened for the first teach in the process. Participants had previously agreed that Mr. Klein would teach the lesson to one of his general education biology classes of 15 students. Ms. Cote, Ms. Chase, and I served as observers during his first teach. Prior to the lesson delivery, team members discussed the importance of collecting data based on the identified points to notice and were reminded that in the LS process observers are expected to not interact with the students or otherwise impact the natural flow of the classroom environment (Lewis & Hurd, 2011). The lesson delivery ran the entire span of the 49- minute class period. The LS PD team agreed to break for lunch prior to debriefing on the observation data. Breaking prior to all post-lesson discussions was implemented as a method for the participants to recuperate and organize their thoughts (Chokshi, Ertle, Fernandez, & Yoshida, 2001).

Prior to any post-observation conference, the group facilitator must reinforce the purpose of Lesson Study focusing on student thinking and learning and not for the purpose of evaluating the teacher (Lewis & Hurd, 2011). According to the literature during the first post-lesson discussion, the team first listens to the instructor's overall reflections on the lesson's goals, the overall performance of the lesson, and any significant difficulties with the lesson. After the instructor has shared information on the

effectiveness of the lesson, each team member is given an opportunity to discuss the lesson and its effectiveness. Finally, the entire team discussed the overall findings and prepared for revising the lesson as needed. Additional optional activities for the post-lesson discussion could have included discussion from invited guests such as teacher audience members or content experts (Lewis & Hurd, 2011). The remainder of the afternoon was used for revising the lesson. The participants reviewed all worksheets, manipulatives, other materials, teaching strategies, and grouping. The LS PD team eliminated laboratory questions that fell outside of the intended learning objectives, added additional details to the instructions for part 2 of the laboratory activity, and added two questions that focused more on the specific learning objectives identified in the planning phase of the lesson design. The LS PD team agreed to deliver the second presentation of the cycle1 lesson on Thursday of the same week.

During the second presentation, Ms. Cote served as the teacher. Mr. Klein, Ms. Chase, and I served as observers of the lesson. The team agreed that Ms. Cote would deliver the second teach to her third period class of general education biology students. The lesson was delivered to 25 students. Once again, the observers selected a group of students to monitor throughout the lesson with the goal of collecting the points to notice data that were connected to the learning objectives. Observers collected the data, noted the time, and the significance of each point to notice as it related to the lesson goals. At the conclusion of the 49-minute lesson, the team agreed to meet again for the second post-lesson discussion after lunch.

After lunch, the LS PD team met once again following the post-lesson discussion protocol where the teacher first shared overall impressions on the effectiveness of the lesson, the observers individually reported on each transition within the lesson, and the entire group was provided opportunities to reflect on what was shared in the second post-lesson discussion. Following the second post-lesson discussion, team members collaboratively completed a final reflection report. Together, the team reflected on what they learned from the Lesson Study process and from revising the lesson and what best helped students learn the target objective. The next day, each of the participants sat for a one-on-one interview, during their conference periods, focused on capturing the essence of their individual experiences as they related to the ROS goals. The LS PD team members elected to meet after school to participate in a post-cycle 1 discussion group activity. After the group discussion, LS PD team members were asked to submit a personal reflection journal describing their experience with cycle 1 of the LS PD model.

Cycle 2. The second cycle of LS began on March 30th and extended into the first full week of April. Prior to the beginning of cycle 2, the participants expressed concern for missing four full days of class time during the month of March for the LS orientation and cycle 1 activities. The team agreed to trade the one full day of planning to half days: one half day in the morning and one half day in the afternoon, in order to minimize time out of class.

The team collaboratively agreed to begin cycle 2 on March 30th, as it coincided with state assessments that had already interrupted the bell schedule for the day. During opening discussions, LS roles shifted so that Ms. Cote was designated as the first teacher

in the cycle, Ms. Chase assumed the role as second teacher in cycle 2, and Mr. Klein was designated as the note taker/typist. Next, the team revisited the agreed-upon group norms that remained unchanged. Additionally, the team revisited their long-term goal or theme: students will think critically using information to solve problems and draw conclusions. LS PD participants then transitioned to the next phase of research in order to document the rationale for selecting a lesson for cycle 2. After reviewing performance data, lesson materials, and the biology curriculum, the team selected a topic based on poor performance on state and local assessments and a review of the state's TEKS resource website. The TEKS resource website designated the topic as a prioritized *readiness standard* that had been assessed on the previous three years of state testing. The topic or learning objective stated that students should be able to describe body systems including their individual functions and interactions with other systems that help to regulate all processes within an organism (TEA, 2015). Unlike the cycle 1 lesson that came from a professional development activity, LS PD group members selected an existing lesson that one of the participants had presented in previous years. The team agreed to begin collecting materials and preparing for the lesson design planning meeting scheduled for Thursday of that same week.

Day 2 of cycle 2 was a half-day session devoted to completing the research phase of LS and transitioning to the lesson design phase. Activities for completing the research phase included a vertical study of the TEKS resulting in the discovery of two learning objectives in grade 7 that should have provided students with some prior knowledge for the current learning target and revisiting the TEKS resource system website and

curriculum materials for the purpose of discovering common misconceptions with teaching the target objective. The participants documented a couple of common misconceptions and a comprehensive list of vocabulary terms that should be a part of the prior knowledge that students are bringing to the classroom.

During the design phase of cycle 2, the participants took the original lesson consisting of two activities or transitions and expanded to include five transitions focusing on prompting student interaction and feedback. Activities included a warm-up question with opportunities for personal reflection in written form, part 1 of a discussion activity that allowed students to share and modify their responses to the warm-up question in groups of two or three, a body system card-matching activity that required students to justify their work, an interactions part 2 activity that required the students to collaboratively infer and justify predicted interactions among body systems, and a closing activity where students presented one example of an interaction between two systems. The teachers listed eight key anticipated responses from students where additional clarification and guidance might be needed. The final step in the lesson design phase included the documenting of seven data collection points or points to notice during the observations. Three of the data points were designated as content expert observations where participants needed to evaluate the accuracy and understanding exhibited by the students during the activities. Four other data points were selected for outside observers or non-content expert observers of which to make note. These four data points focused mainly on the flow of the lesson and the use of content-specific language during student

interactions. Day 2 concluded at approximately 5:00 p.m. in the afternoon with a run-through or final rehearsal prior to the scheduled delivery for the following Monday.

Participants gathered the following week on day 3, Monday, for the first teach of cycle 2. Ms. Cote conducted the lesson lasting the entire 49-minute period. Mr. Klein, Ms. Chase, and I collected observation data on the points to notice as agreed upon in the planning stages of cycle 2. After lunch, Ms. Cote initiated the first post-lesson discussion by sharing her impressions of how the lesson went with regard to meeting the lesson's target objectives and discussing potential barriers or difficulties with the lesson. Each member of the observation team shared their impressions on each of the five phases of the cycle 2 lesson design. The first post-discussion session of cycle 2 concluded with participants reflecting upon each other's contributions while considering changes that might improve the effectiveness of the lesson. Adjustments to the lesson design focused on student engagement. The team agreed to have each group member responsible for producing a lab sheet; extension activities were added for students who finished early and some additional points of clarification and instructions were added to aid in the flow of the lesson. After the adjustments were documented, the team collaboratively reviewed the changes in preparation for the second teach scheduled for the next day.

Unlike the first teach in cycle 2 where the lesson was taught to a group of general education biology students, the second lesson delivery was to a group of 17 biology honors students. Ms. Chase assumed the role of teacher with Ms. Cote, Mr. Klein, and me serving as observers. Once again, the observation team focused on the data collection points or points to notice that were identified in the preplanning stages of cycle 2. The

LS team reconvened after lunch for the debriefing where Ms. Chase shared her perception of how the lesson addressed the target objectives and reflected upon the adjustments in the lesson and how they impacted student learning. Each member of the observation team shared perceptions of how the lesson impacted learning on each of the five transition activities that were presented during the second teach of cycle 2.

Cycle 2 concluded with the team collaboratively completing a final reflection report that summarized what the team had learned from the lesson study process in cycle 2, what the team learned from revising the lesson, and what best helped students learn the target objectives. One-on-one interviews were scheduled for the following day during the teachers' conference period. A discussion group interview was scheduled two days later. After the discussion group interview, cycle 2 concluded with the team scheduling the third and final lesson cycle for mid-May. LS PD participants were asked to submit a personal reflection journal for cycle 2 the following week. Additionally, the group requested holding more of the planning meetings before or after school in order to limit the amount of time the teachers were out of the classroom. The group's previous adjustment in shifting the full-day planning to two half-day sessions and having already completed the LS orientation during the cycle eliminated one full day of missed class time during cycle 2.

Cycle 3. The third cycle in the LS PD initiative began during the second full week of May. As requested by the LS PD team, the meeting was scheduled for a two-hour session after school on Monday. Cycle 3 opened with a reassignment of lesson study roles, revisiting the group norms, and the team's long-term goal or research theme.

As with cycles 1 and 2, I continued to serve as LS facilitator. Ms. Chase delivered the first teach in cycle 3, Mr. Klein provided the second teach, and Ms. Cote served as the group's note-taker/typist. Participants swiftly transitioned into the research phase of lesson study: reviewing performance data, prior student work, and curriculum resources with the goal of selecting a lesson for cycle 3. A lesson focused on another prioritized *readiness standard* that called for students to be able to understand cellular processes including homeostasis, energy conversions, transport of molecules, and synthesis of new molecules (TEA, 2015).

Similar to LS cycle 1, participants selected an existing lesson received during a professional development session at the local Region 20 Education Service Center. Next, the LS PD team members revisited curriculum documents and the TEKS Resource System's Instructional Focus Documents in an effort to study potential misconceptions or learning barriers that might arise during the teaching phases of cycle 3. Potential misconceptions identified revolved around student confusion between types of transport systems and similar vocabulary terms. During the vertical alignment investigation portion of LS, two seventh-grade TEKS learning objectives were identified as supporting standards for the current biology target objective. After a progress check, the team agreed to adjourn and meet for a second after-school session the following day.

On day 2, the team focused on the lesson design phase including selecting student learning activities, identifying anticipated student and teacher responses, and documenting important points to notice during the observation phase of LS. Four student learning activities or transitions were built into the lesson. During the first activity,

students were provided with a warm-up activity and an opportunity to write a self-reflecting response. The second activity was described as part 1 of a laboratory activity where students met in small groups of no more than three to share their warm-up reflections and change their responses as needed based on the conversations. During part 2 of the laboratory activity, students continued to work in their group while attempting to match a type of cellular transport with various properties of the process. Students were asked to match various descriptors to the type of movement or transport system. Transport descriptors were printed on cards stating how the movement was occurring, what the transport system was moving, and where it was moving in terms of concentration. Seven short answer questions were built into part 2 of the laboratory activity.

During the fourth and final phase, or closing activity, groups were asked to share their understanding of cellular transport systems with the other collaborative learning groups. The LS team then reviewed its progress and decided to adjourn for the evening and reconvene the next morning to complete the remaining portions of the lesson design. The team agreed to meet before school and take advantage of the Collaborative Wednesday schedule that would give them a full two hours to complete the planning phase for cycle 3 of the LS PD initiative.

On the morning of day 3, the LS team identified nine anticipated student responses relating to potential misconceptions or learning barriers throughout the lesson. Participants also identified four general points to notice during each of the four student learning activities in preparation for the observation phase of the LS cycle 3

presentation. The four general points to notice were then to include more detail for a total of seven points during the lesson observations. Four of the seven points to notice were assigned to content expert observers. The points to notice focused on checking for student accuracy in matching cellular transport systems with their properties and identifying any additional misconceptions the students may have encountered during the activity. Three of the seven data collection points to notice were assigned to outside observers or non-content experts. The remaining three points to notice focused on student engagement, collaboration, and the student's ability to summarize their understanding of transport systems. The team once again checked their progress and decided to schedule an after-school lesson rehearsal for the following day, Thursday, with the first teach scheduled for Friday of the same week.

The LS team met for approximately one hour after school on Thursday. Participants examined all lesson documents and manipulatives for accuracy prior to the lesson rehearsal. Ms. Chase walked the team through the lesson in preparation for the first teach of cycle 3. The participants agreed that the first teach should continue as scheduled the following morning.

On Friday morning, Ms. Chase delivered the planned activities for lesson cycle 3 of three in the LS PD initiative. The 21 students participating in the activity were in Mrs. Chase's third-period honors biology class. Mr. Klein, Ms. Cote, and I served as lesson observers collecting data on the agreed-upon *points to notice* during the planning stages of the LS PD cycle 3. Participants agreed to reconvene after lunch in order to complete the first post-lesson discussion in cycle 3.

On the afternoon of day 5 of cycle 3, Ms. Chase led off the post-lesson discussion by sharing her impressions of the lesson with regard to meeting the established lesson targets as well as any particular learning obstacles perceived during the presentation. Each of the lesson observers shared points-to-notice data from each of the four student learning activities created during the lesson design phase of cycle 3. The LS PD group members reflected on each other's contributions to the discussion and reviewed the student worksheets and the manipulatives used in the activities. After a lengthy discussion, the teachers agreed to remove one section of the lesson that absorbed an inordinate amount of time. Additionally, after reviewing the student worksheets, the team agreed to reinforce that students needed to write answers in complete sentences. This information was to be added to the lesson instructions and reinforced by Mr. Klein during the second teach. After reviewing changes, the LS PD participants agreed to adjourn and reconvene the following Monday for the second teach in cycle 3 of the LS PD initiative.

On the morning of day 6, Mr. Klein presented the second teach of cycle 3 to a third- period honors class of 19 students. Ms. Chase shifted to the role of observer along with Ms. Cote and me. After lunch, the team reconvened for the second post-lesson discussion in cycle 3. Mr. Klein led the discussion sharing his perceptions regarding the lesson's ability to address the specified target objectives. Each of the observers shared perceptions on each of the four student learning activities designed during the planning stages of cycle 3. The team agreed on a couple of additional tweaks to the lesson in the

way of extension activities that would require the students to share-out the placement of their body system cards verbally with a partner.

Additionally they added a classroom organizer chart to allow for students to observe all of the cooperative learning groups' results and rationale. It is important to note that although additional changes were made to the lesson after the second teach, a third teach in cycle 3 was not scheduled. One of the important attributes of LS is that it should have a definite beginning and end despite any additional adaptations to the lesson after the agreed-upon number of presentations (Lewis & Hurd, 2011). The participants in the LS PD initiative agreed with this idea and decided they could use these most recent adaptations when they presented the lesson in the following years.

The LS PD team brought cycle 3 of three to a close by collaboratively completing a final reflection report by reflecting on what they had learned from the LS process, what they learned from revising the lesson, and what best helped the students reach their target goal. Team member comments focused on the importance of removing a graphic organizer that simply asked students to re-copy information that was given to them, removing other reference materials that hindered the progress of the lesson, and allowing students to check each other's work with the use of an answer key. After completing the final reflection report, each of the three participants sat for one-on-one interviews the following day during their conference periods. A group discussion interview was scheduled for two days later. And, finally, participants were asked to submit a personal reflection journal for cycle 3 the week after completion of the current cycle. Participants agreed to hold a final LS PD dissemination meeting during the first

week of June that would include district administration, high school teachers, and science teachers from the elementary and middle school levels.

Dissemination presentation. As project facilitator, it was my role to design the dissemination presentation PowerPoint with collaborative input and approval from all participants. Presentation information included a brief review of the literature addressing the problem where there was a lack of quality professional development for secondary biology teachers. The presentation also covered the LS PD activities, objectives, and goals including timelines for each of the three LS cycles. Specific information shared with regard to the activities was an overview of the LS process including orientation, lesson research, lesson design and planning, the first teach, editing and revising, re-teaching, and a final reflection report. Additionally, the presentation reported on each of the three ROS goals:

1. Teachers will assess the value of the LS PD process as a potential solution to the ROS problem presented where there is a lack of quality professional development for secondary biology teachers.
2. All biology teachers will report professional growth throughout the LS PD process.
3. Biology teachers will develop a sustainable form of LS that can be replicated within the local context.

The LS PD dissemination presentation audience included eight administrators from the elementary, middle, high school, and district levels; 10 elementary and middle school science teachers; six high school science teachers; and an additional 14 high

school teachers from various core content areas. The LS PD presentation covered two hours with occasional dialogue occurring throughout between the audience and the LS PD participants. At the conclusion of the presentation, an additional 30 minutes was reserved for comments and questions from the audience. At the conclusion of the presentation, the audience completed a four-question post-LS initiative dissemination questionnaire designed to investigate the perceptions of the audience with regard to each of the three LS PD initiative's goals.

Summary

At the conclusion of each of the three cycles, debriefing sessions were held with my field supervisor in addition to the one-on-one interviews and group discussions. After completing all three cycles, participants collaboratively developed the summative LS PD dissemination presentation for MVHS staff members, district administrators, and district science teachers. Although a wealth of collaborative dialogue and instructional information was shared throughout the LS PD process, data collection efforts were focused on the three main goals established in the ROS.

Data Collection and Analysis

A preliminary review of the methods for collecting information from human subjects determined that the methods proposed for this study did not meet the federal definition of "human subjects' research with generalizable results." As the proposed information gathering methods were within the general scope of activities and responsibilities associated with my current position, I was not required to seek human subjects' approval. Please see Appendix B that contains a copy of the email

communication regarding the IRB's decision concerning this study. The interconnected relationships between the LS PD intervention's goals, objectives, guiding questions, methods, and rationale can be found in Tables 2 and 3. The information included in the tables outline how the LS PD inputs might result in a greater understanding of the LS PD model as a potential solution to the ROS problem.

Protocols and Instruments

Data collection methods followed qualitative approaches to capturing the essence of the feelings of the participants toward LS PD as a viable solution to a lack of quality PD at the secondary level. Qualitative collection methods included participant reflection journals, one-on-one interviews, discussion group interviews, and a final dissemination presentation questionnaire.

In this study, multiple data resources were used. Participants were asked to maintain a personal journal for the purpose of reflecting on their experiences throughout the LS initiative (see Appendix C). These journals served as only one source of data. The researcher developed three data collection instruments including: (a) a semi-structured interview protocol (see Appendix D), (b) a discussion group protocol (see Appendix E), and (c) a post-LS initiative dissemination questionnaire (see Appendix F). The interview protocol included open-ended questions that were posed to each of the three biology teacher participants. The interview protocol was semi-structured; that is, emerging questions were posed during the conversation and some of the questions were not opposed in all situations (Creswell, 2013). The personal interviews were conducted in a one-on-one setting. The discussion group interviews included similar items as the

individual interview protocol but were worded differently. Discussion group interviews were conducted with all three biology teacher participants in attendance.

Table 3

Guiding Questions, Data Collection Methods, and Rationale

Guiding Questions	Data Collection Methods	Rationale for Methods
1. What are the perceptions of the participants about the viability of LS as a solution to the lack of quality PD for secondary biology teachers?	I will conduct one-on-one interviews at the conclusion of each LS cycle. I will use the constant comparative method to analyze the transcriptions of the conversations and the field notes. I will identify specific themes, interests, and concerns of teachers in regard to the LS process as a viable solution to the presented problem	Triangulating teachers' perceptions throughout the process through group and individual data collection should establish a more valid understanding of the participants' perceptions (interview, discussion group interactions, and researcher observations/field notes). Individual data gathering activities (interviews and reflection journals) will provide avenues for all participants to have a voice in the process.
2. What are the perceptions of the participants in regard to their own professional growth as a result of participating in the LS initiative?	The biology teachers will participate in discussion group interviews and complete personal reflection journals during each LS cycle. I will complete individual interviews with participants at the conclusion of each of the LS cycles.	Validating teachers' perceptions on professional growth through individual (journal/interview) and discussion group interviews might establish a more accurate understanding of the participant's growth.
3a. What are the perceptions of the LS dissemination audience toward LS as a viable solution to a lack of quality PD for secondary biology teachers?	Dissemination presentation audiences will complete final dissemination presentation questionnaires focused on replication and sustainment probabilities.	Analysis of the interest levels of the audience should provide informational data about the potential for replication and sustainability of the LS process as a viable solution to the presented problem.
3b. What improvements to the LS PD model might facilitate future implementation?	Participants will complete participant reflection journals, one-on-one interviews, discussion group interviews, and a final dissemination presentation questionnaire documenting the LS process.	The LS process is designed to be iterative. Formative participant reflection journals, one-on-one interviews, and discussion group interviews, coupled with the final dissemination presentation questionnaire, could lead to a locally designed LS model that can be replicated.

The purpose of using similar questions in more than one instrument was to collect data from different sources, which in turn, was used for triangulation purposes (Creswell, 2013). The post LS initiative dissemination questionnaire included similar items as the interview and discussion group protocols, but the participants completing the questionnaire included feedback from invited guests including administrators and science teachers from elementary, middle, and high school campuses. Data collection occurred at the conclusion of each of the three LS cycles. A total of nine one-on-one interviews were conducted with each of the three biology teacher participants. Each interview took place in my office and lasted approximately 30 minutes. Three discussion group interviews were held in the high school conference room. Discussion group interviews lasted approximately 60 minutes. One-on-one interviews and discussion group interviews were audio-recorded using an iPhone and backed-up with an iPad recorder. The recorded data were transcribed and stored, along with the digital audio files, on my password-protected office computer.

Analysis of Data

This LS PD investigation used a case study approach that sought to understand the essence of the three biology teachers' perceptions of the LS PD experience and how it related to the proposed ROS problem where there is a lack of quality PD for secondary biology teachers (Creswell, 2013). In this case, the shared experience is the LS PD model segmented into three cycles during the spring semester of 2015.

Qualitative analysis included processes for organizing, transcribing, reading, re-reading, memoing, coding, categorizing, patterning, and identifying emerging themes

within the data with regard to teacher perceptions of the LS PD initiative (Creswell, 2013). The process for analysis was ongoing to include one-on-one interviews and group discussions with participants at the conclusion of each of the three LS cycles. Additionally, participants completed reflection journals at the conclusion of each LS cycle. Qualitative data collection documents and interview transcripts were analyzed using a constant comparative method where an ongoing review of emerging themes was compared to the current set of collected data (Denzin & Lincoln, 2011). The constant comparative method employed an iterative analysis of qualitative data where each in a series of incidents was analyzed as part of an ongoing process. The constant comparative process began when an initial incident was coded for as many emerging categories as possible. During each subsequent incident, the coding process became more refined, integrated, and delimited as reoccurring themes emerged (Glaser & Strauss, 1999). Study results were presented as a narrative discussion incorporating the participants' perceptions, previous research, and future implications (Creswell, 2012).

Issues of Reliability, Validity, Confidentiality, and Other Ethical Concerns

Because the data collected in this study were qualitative, I triangulated my findings using more than one research instrument (Creswell, 2012). Individual interviews, discussion group interviews, and teacher questionnaires explored the participants' experiences with the LS method and their perspectives of its effectiveness on their PD. These instruments included questions that were worded differently, yet asking the same phenomena. Collecting qualitative data from multiple sources using multiple collection tools allows for the corroboration or triangulation of evidence that

added additional power to the analysis. Additionally, the participants were active contributors to the dissemination presentation allowing for member checking for accuracy in the findings.

Creswell (2013) recommended that confidentiality and power imbalance were two significant ethical issues with qualitative studies that each researcher should consider. In this study, concerns over participant confidentiality were addressed through the use of name coding. None of the participants' real names or any of their identifiable information was included in the ROS. I served as an administrator on the participant's campus; therefore, concerns for imbalances of power were addressed through open and honest dialogue clearly articulating the purpose of the study and its data (Creswell, 2013). In the case of this study, our intent was to collaboratively investigate LS PD as a viable solution to the problem of a lack of quality collaborative, content-specific, coherent trainings that were connected to practice. Although we have conducted similar investigations, we have never explored an initiative using an approach anywhere similar to the methodological rigor used during the research conducted during the current ROS.

CHAPTER IV

RESULTS AND DISCUSSION

Results

A constant comparative analysis of each of the three Lesson Study cycles and the dissemination presentation facilitated the identification of several themes through a process of data saturation where the evolving themes emerged through an iterative review, refinement, and reduction (Glaser & Strauss, 1999). The emerging themes are presented as responses to each of the four research or guiding questions. All participants agreed the LS PD model was a viable solution to a lack of quality professional development for secondary biology teachers. General themes associated with approval for the LS PD model included *opportunities for collaborative observations* and *collaborative student-centered lesson design*. The LS PD team did express significant time constraint concerns associated with implementing the LS PD process. Initially, participants showed concerns for perceived redundancy or repetitiveness in the process. These initial concerns subsided as the team members completed cycles 2 and 3 of the LS PD initiative.

In response to research question 2, all participants reported areas of professional growth relating to designing quality lessons from the students' perspective and rediscovering the importance of checking for understanding in a variety of ways. In response to research question 3, the LS PD group offered several recommendations for adapting the LS PD process to fit the needs of the local context resulting in long-term

sustainment. These adaptations centered on addressing time constraints and generating stakeholder buy-in in an effort to scale up the LS PD initiative. Finally, the LS PD dissemination audience addressed research question 4 by reflecting on all three of the previously mentioned research questions.

Research Question 1

What are the perceptions of the participants about the viability of LS as a solution to the lack of quality PD for secondary biology teachers?

Each of the participants described the LS PD initiative as a welcome change to traditional PD:

> **Klein** (a pseudonym): "I don't believe that there is a whole lot of quality professional development out there. Other professional development all they do is tell you something and you don't get to use it, you don't get to see it in action."
>
> **Cote** (a pseudonym): "This year was my first year with any type of professional development specific to my content. I think all of the other ones that I went to were good. They were effective to help with differentiation and inclusion in special education; but not really any kind of type of development that could help me with my content."
>
> **Chase** (a pseudonym): "I don't think there is a whole lot out there that can be used or that is kind of universal for all grade levels or subject areas, kind of like LS is."

All three of the LS PD participants agreed that opportunities to observe and collaborate with peers was a major benefit that was unique to the process. Mr. Klein

shared how collaborative observations allowed him to witness student and teacher reactions in a live classroom setting helping him to more readily identify and address student misconceptions. Mr. Klein specifically mentioned how live observations helped him in paying more specific attention to students when they speak and write as a method for identifying misconceptions: "I really liked seeing what the students' thoughts were; how they processed it; how they did the lesson; how they thought about the lesson; and then how they communicated it on their paper." Mr. Klein also mentioned that opportunities to observe alternate teaching styles and philosophies was another benefit of participating in the LS PD initiative.

Ms. Cote added that peer observations were beneficial in identifying and handling specific situations in a live classroom setting. Ms. Cote felt that her ability to predict student responses and anticipate potential misconceptions among students increased as the process progressed. Ms. Cote shared how she learned from both veteran and new teachers during the teaching and observation phases of the LS PD process.

Finally, Ms. Cote expressed how the LS PD observation protocol helped build a sense of collegiality, trust, and continuity among the biology department. When asked how she might describe the experience to a peer who had not participated in the initiative, Ms. Cote stated: "It's going to enhance the entire department overall in the way that you guys collaborate and get things done and maybe help each other out." Ms. Chase found value in observing live lessons while analyzing them from multiple perspectives including her peers, but more importantly experiencing the lesson through

the eyes of her students. During one of our discussion group meetings, Ms. Chase differentiated between the teacher and student perspective when designing lessons:

> Teachers can look at their lessons in a different way and look at them or try to see it from the student's point of view, so then can try to make it a better, more meaningful activity for the student and not just focus on themselves and how they think they need to teach it.

As a first-year teacher Ms. Chase felt that she made significant contributions to the group by sharing the latest information and best practices from her recent college coursework while also benefiting from observing experienced teachers in her department: "I think it's helpful to have the new information and the old information and kind of blend that together." Ms. Chase also found comfort in LS's disarming approach to peer observations where the focus is on improving lessons for student learning versus teacher evaluation.

A second theme under research question 1, receiving unanimous approval by the LS PD team, was *focus on the student*. Mr. Klein described LS as a collaborative lesson design process allowing participants to evaluate lessons and how students think and respond. Mr. Klein noted the importance of the LS approach in identifying specific themes and goals based on student data during the proactive planning stages. He placed significant value on the LS protocol for analyzing student products and dialogue focused on identifying and addressing student and teacher responses throughout the process. When asked how he might explain the collaborative experience of LS to a colleague who had not participated in the initiative, Mr. Klein stated:

> It gives you an opportunity to collaborate with peers about the lesson, to see how lessons were and also be able to observe other teachers teach in their classroom and to come back together again to share your ideas about how it might be improved.

Finally, he felt like the LS approach was congruent with implementing state standards and improving student performance on standardized assessments. Ms. Cote echoed Mr. Klein's sentiment for LS's focus on specific objectives and outcomes. She also reported that LS calls for a paradigm shift away from teacher preferences in lesson design toward a focus on student learning. Ms. Cote explained how proactively studying curriculum vertically through the analysis of learning objectives at the lower grade levels allowed for greater accuracy in predicting student misconceptions prior to the lesson delivery. She valued the collaborative student-focused lesson design for providing participants with opportunities to dissect lessons, anticipate responses, and identify points to evaluate for the purpose of improving lessons focused on student learning. Ms. Cote described the experience: "You're actually dissecting the lesson, going back and anticipating the student responses and what you wanted to look for in the evaluation. I think that was the meat of it."

Ms. Chase noted LS's flexibility in allowing for adjustments that address student needs as a positive attribute of the process. She made specific reference to LS's focus on content and its correlation to specific goals outlined during the planning stages of the process. Ms. Chase summarized her experience in collaboratively dissecting lessons from the perspective of a first-time teacher: "They definitely don't teach this stuff in

college. I have never broken down the lesson like that before and looked at each specific part and made sure I had goals for the lesson as well as following the objective."

In summarizing the value of the LS PD model as a viable solution to a lack of quality professional development, Mr. Klein compared the initiative to traditional professional development: "Usually, we were exposed to things like setting up lessons but never seeing how they are taught and never seriously seeing what the consequences are of what we did in setting up the lesson."

Although the team agreed the model was a viable solution to the presented problem of practice, participants in the LS PD initiative expressed concern for the amount of class time missed during the process. During the first of three cycles, participants missed three full days of instruction over a four-day period. Additional time constraint issues were amplified by the lesson selection for cycle 1. The participants had selected a lesson from a recent professional development activity that focused on very specific deficiencies in the students' learning; however, the activity did not fall within the current curriculum sequence. In other words, it did not fall within the course timeline. The LS PD team was aware of this constraint but felt they should introduce the lesson as a re-teach, on a topic covered in the fall semester, in preparation for state assessments scheduled for later in the semester. Due to the ongoing nature of the LS PD initiative, participants chose to modify their meeting schedule in cycle 2. The team elected to meet for half-day planning sessions versus full-day sessions in order to meet with their classes on an alternating schedule of a.m. and p.m. meeting times. The team

elected to modify meeting times again during the third cycle resulting in eliminating one full-day of missed class time.

Initially, Ms. Cote and Mr. Klein expressed concerns for the redundancy or repetitiveness of the LS PD process. Initially, Ms. Cote felt that "things were repetitive. Some things maybe could be streamlined and the main focus of our group discussion should be how we can be more efficient in the classroom." Mr. Klein stated that "redundancy seems to be built into it. That can get to where once you get used to it, you might get more complacent at the end." Over the three-cycle period, the team recognized that the perceived redundancy in the process was both purposeful and essential to the LS PD process. When revisiting her comments on the repetitiveness of the LS PD process after cycle 2, Ms. Cote stated: "On the first lesson, I thought 'Wow, there is a lot of repetitiveness,' but this time I saw the point of the repetitiveness. We have to make sure we understand the goals." Mr. Klein reevaluated his position on the redundancy of LS after cycle 3:

> The good thing is that you have to follow that same pattern. But first you have to learn the pattern. So we could do the first one like we did this last one, quickly, because we had to learn the process. We had to learn what the expectation of the lesson process was.

Research Question 2

What are the perceptions of the participants in regard to their own professional growth as a result of participating in the LS initiative?

The first of two emerging themes relating to the participants' professional growth revolved around lessons learned through designing quality lessons from the students' perspectives. Mr. Klein felt that one of the most important lessons learned from the LS process was that lesson design should be focused on student thinking. He expressed a concern for failing to focus on the students when designing lessons in the past and just going through the motions of completing a lesson. Mr. Klein stated: "I don't think about, sometimes the way students think when I do something. I just, I just do it." Mr. Klein also learned to appreciate the student perspective when designing a lesson. He shared:

> I learned, when you look at something, you will look at it totally different than what students look at. With your knowledge base and the base of information you already have, you see things totally different; you read through and go 'oh, yeah. They should be able to do that; no problem.' And you get there and it's the biggest part that they don't understand.

Mr. Klein felt it was also important to share how observing both advanced and general education classes during cycle 2 helped him to consider all students' needs when designing and revising lesson plans.

Ms. Cote agreed with Mr. Klein that teachers should not assume that students are at the same knowledge level as the teacher. She also had value for LS's approach to targeting specific learner-centered goals proactively versus simply completing a lesson and moving on to another topic. Ms. Cote stated:

> I feel I have grown as an educator by removing myself from the normal thought process of creating lessons just to complete an objective. The main purpose of LS

is to create lessons collaboratively with the group of teachers that want to increase student involvement and have students perform and understand the content at a higher level.

Ms. Cote shared a similar experience as Mr. Klein. Ms. Cote explained how observing advanced learners—she has no honors classes—allowed her to see the level of rigor she can attain with her students by providing additional scaffolding when designing lessons from the students' perspectives. Ms. Cote summarized her feelings for the LS process and planning lessons from the student perspective by stating: "It's a way for us to just kind of step back and almost put ourselves in our students' shoes."

Ms. Chase also agreed that lessons should be designed from the students' perspectives and individualized needs. She explained how participating in the LS initiative encouraged her to consider prior student performance and anticipate difficulties when proactively designing lessons from the students' perspectives. She recalled how the LS process not only accounted for anticipating potential misconceptions in the planning process, but also including teacher responses to those potential misunderstandings during the preplanning and revision phases of the initiative. Ms. Chase also explained how her ability to anticipate potential student misconceptions improved throughout the three-cycle process. Ms. Chase summarized her feelings toward LS's role in considering student perspectives when planning by stating: "I think that it makes you a better teacher because you're not thinking about yourself. You're kind of bettering your understanding of the students' understandings." Ms. Chase also mentioned how observing classes with varied learning abilities helped her to consider

student perspectives when designing lessons. She specifically mentioned how LS helped her differentiate within her classes ensuring she was getting the most out of her students.

The second professional growth theme centered on the participants' renewed appreciation for checking for understanding in the lesson planning and implementation process. Mr. Klein shared how he was always aware of the value of checking for understanding, but was reminded of the importance of student dialogue and collaboration in monitoring student comprehension. His take-away from the experience reminded him that the combination of monitoring student dialogue, written explanations, and collaborative projects are of equal value in checking for understanding and revealing misconceptions. He explained how "the verbalization or written explanation can provide teachers insight into student misconceptions and allow for clarification of those misconceptions."

Mr. Klein also shared a concern for his students to consistently engage in collaborative activities. He suggested that students might need additional training or more opportunities to participate in interactive activities in order to develop their collaborative proficiencies. Mr. Klein found value in the team's use of warm-up activities where students were asked to individually write reflection statements on a given question and then were given opportunities to discuss their answers and modify them as needed. When reflecting on these types of interactive activities and their value with regard to checking for understanding, Mr. Klein shared:

> I found that the warm-up activity is a very necessary part of every critical lesson to get these kids thinking about what the material is . . . to use the warm-up as a

> gauge to evaluate whether or not they learned what I wanted them to learn from the lesson.

Additionally, Mr. Klein shared how observing the understandings of advanced learners in honors classes and contrasting them with comprehension levels of general education students "shows us where we need to go."

Ms. Cote also found warm-up activities to be instrumental in checking for student understanding. She specifically mentioned that closing the lesson was equally important in gauging student comprehension. Ms. Cote explained how she has shifted from simply using warm-ups as an activity while she takes attendance to a more targeted purpose. She stated:

> You don't really think about the warming up part to help them understand the material at the end. But now it's like, "Okay, I really want to get them to think about what we're going to be talking about today."

Ms. Cote also learned to proactively check for understanding during the research phase of LS where participants study data, establish targeted goals for specific lessons, and develop a valid rationale for the lesson. She described how the LS's protocol for studying the curriculum vertically allowed her to consider the students' potential understandings before they even walked into her classroom. She described how she must consider learning objectives and student performance from earlier grades to provide "information that they should be walking in my room with . . . . That way we can build off of that instead of just working backwards." This idea speaks to not only assessing the

students' current knowledge but also considering the students understanding of prior knowledge.

The idea of proactively considering student understandings resonated with Ms. Chase. She described how LS's purposeful planning, including anticipating student responses, helps to reduce stress on the students during the lesson: "I think it's just all of the focus being on the student and how can you prevent them from getting confused." Ms. Chase found common ground with both Mr. Klein and Ms. Cote on the benefits of observing honors and general education classrooms. She expressed that monitoring the understandings of these diverse learners helped her in providing differentiated instruction benefiting all students.

Research Question 3

What improvements to the LS PD model might facilitate future implementation?

Two major themes emerged with regard to enhancing the LS PD model for future implementation and expansion. The first related to factors associated with *time* and was a central concern for all participants in responding to research question 1. Future LS PD participants would need significant amounts of time to research, plan, teach, revise, reteach, and collaboratively reflect on the process. LS PD participants offered a number of potential solutions for the time constraints they experienced during the semester-long initiative. The second theme was categorized by a number of *sustainment factors* that should be in place in order to ensure future LS PD initiatives were well supported. Sustainment factors were categorized under the headings of needed support and buy-in for future participants.

Time constraints. Due to the nature of the LS PD model as an ongoing professional growth initiative, participants were able to address time constraint issues throughout the three-cycled process. During the initial LS PD cycle in March, participants missed a total of three full days of instruction relating to the initiative's required activities. After the first cycle, the participants elected to use two half-day planning sessions versus a single full day of missed classes. Although LS PD members could see at least half of their course load, the teachers essentially missed three full days of class during cycle 2. As the team became more comfortable with the LS PD model, participants agreed to conduct all planning meetings before or after school. The first or initial teach and revision lasted one full day where teachers were out of the classroom. A second full day was dedicated to the reteach and reflection phases of the process. The participants agreed that the cycle 3 approach resulting in two full days of missed classes was both appropriate and acceptable. Each of the three participants shared a number of additional adaptations possibly facilitating future implementation of the LS PD model as a viable solution to a lack of quality professional development for secondary teachers.

Cycle 1. At the conclusion of cycle 1, Mr. Klein offered several potential improvements for future implementation of the LS. Mr. Klein began the discussion by mentioning how the team had selected a remediation lesson from a recent professional development session the group attended that fell outside of the scope and sequence of the Middle Valley High School curriculum timeline. He expressed how he felt it was a good idea; however, in addition to missing three days of classes as a teacher, deviating from the curriculum timeline may have caused some confusion in getting the students

back on the timeline. Mr. Klein suggested that in the future, the team might consider selecting a lesson fitting within the timeline for the sake of congruency in working with the students. He explained: “We need to work it so that we do those within our timeline, so that the kids are getting content and we’re not making them do something different than what they’re doing are supposed to be doing in class.”

Mr. Klein suggested we may be better served in selecting an existing lesson that the team has had experience with but would like to improve upon. He also suggested that the group might want to devote time before school, after school, on weekends, or over the summer to accomplish some of the preparation requirements. Mr. Klein talked about how MVHS’s Collaborative Wednesday schedule might offer additional planning time for the team. And, finally, he discussed how the process might be more efficient if participants circulated emails sharing ideas outside the formal meetings.

Ms. Cote agreed with Mr. Klein in that future implementation should include selecting a lesson in the curriculum timeline that was somewhat familiar to the group. In other words, the group should not see the lesson for the first time during the LS process but choose a familiar lesson they wished to improve. Initially, Ms. Cote felt the LS process was somewhat repetitive, which contributed to time constraints. When describing the LS experience Ms. Cote stated: “It was kind of . . . . Things were repetitive. Some things maybe could be streamlined and the main focus of our group discussion should be how we can be more effective in the classroom.” Concerns for the repetitiveness of the LS process would resurface in cycles 2 and 3.

Ms. Chase agreed with her colleagues stating that time out of class was a major concern and that students appeared to be confused when the remediation lesson was presented outside of the curriculum timeline. Ms. Chase, who served as an observer for both the initial teach and the reteach, suggested that we increase the number of teaches despite additional time constraints. She stated: "I know the second time (teach) we did some stuff that didn't work. So it would be interesting to fix that stuff and then try it again." At the conclusion of cycle 1, the team agreed to eliminate the whole-day planning session for two half-day planning meetings with the hope of spending additional time, or at least a half day, with students during the instructional week.

Cycle 2. At the onset of cycle 2 during the month of April, participants appeared to be more familiar with the LS PD process. The teachers arrived prepared for the research and planning activities with several proposed lessons for the study. After concluding research on student performance data, analysis of the biology curriculum, and potential misconceptions, the team selected a lesson proposed by Ms. Cote. It is also important to note that unlike the lesson in cycle 1, the lesson selected for cycle 2 fit within the curriculum timeline. The team took the lesson through the LS PD process of research, planning, teaching, refining, re-teaching, and reflecting on their personal growth. At the conclusion of cycle 2, participants shared their experiences with regard to research question 3.

According to Mr. Klein, issues with the time constraints continued to be a concern for the group during cycle 2. He suggested that we continue to try and find creative ways to plan outside the formal meetings of the LS PD process. Mr. Klein

mentioned how the group benefited from sharing information through email. He also shared how team members were taking on assignments such as creating manipulatives and tweaking worksheets outside the formal meetings, then bringing the information to the planning sessions for final approval and implementation. Mr. Klein concluded his comments on the time constraints of the LS PD process by suggesting that participants should opt for shorter, more frequent meetings, continue informal discussions outside the scheduled planning sessions, and complete only one cycle per semester. Mr. Klein also expressed concerns for scaling up the initiative:

> Everybody can't do it. You will be spending too much time out of class for all teachers because, if you wanted to do it with a biology department and a chemistry and a physics and everybody . . . but you have to start someplace.

This idea was based on the need for multiple substitute teachers during the instructional day.

During the cycle 2, Ms. Cote addressed Mr. Klein's concern for additional time constraints possibly occurring with scaling up the LS PD initiative to other departments. She agreed it would be difficult but stated that proper planning department meetings could be staggered in a way that would allow for scaling up the LS PD initiative across departments. She explained:

> Maybe the departments could kind of schedule where we are not all meeting at the same time. You could schedule, you know, say one month science department, next month math, next month . . . that way they could all have the experience with it.

Ms. Cote also was more proactive in cycle 2, which contributed to greater efficiency in implementation. She described how the participants bringing proposed lessons for the team's consideration in cycle 2 helped to move the process along. She explained how working with a familiar lesson where teachers had some background and experience was also beneficial. Ms. Cote agreed with Mr. Klein that missed class time in cycle 2 continued to be a concern. She echoed the sentiments on implementing shorter, more frequent meetings outside of class time. Additionally, Ms. Cote agreed with Mr. Klein where participants could create, edit, or tweak materials such as worksheets and manipulatives prior to the planning sessions and simply bring them to the meetings for final approval and implementation. In other words, clerical work could be divided among team members and completed outside of the formal planning meetings, thereby eliminating the need to be out of class for extended amounts of time.

During her reflections on cycle 2, Ms. Chase agreed with the other participants that trading half-day versus full days during the planning stages of LS was more efficient than in cycle 1. Ms. Chase also agreed that preplanning activities such as bringing proposed lessons, revising worksheets, and creating materials helped to make cycle 2 a more efficient process. She praised her team members for coming up with the idea stating: "I like what they are saying about coming in with kind of already knowing what you're going to say instead of just you know starting there with a completely blank slate." She also agreed with the second change where teaching and improving a familiar lesson within the curriculum timeline was another significant improvement from cycle 1. Although modifications to cycle 2 addressed some of the time constraint issues, the

group decided to make additional adjustments in cycle 3 in an attempt to make the process even more efficient.

Cycle 3. In an effort to further reduce time out of the classroom in cycle 3, the participants agreed to have shorter, more frequent meetings before and after school. The adjustment eliminated one full day of missed class time. The team agreed on several time-efficient practices that resonated throughout all three cycles including taking a proactive approach to preparing and revising materials outside of formal meetings, selecting lessons familiar to the participants, and ensuring that the lesson fits the curriculum timeline. Although the team was able to design a more time-efficient approach for the planning phases of the LS, the team members suggested that meeting times be a flexible component dependent upon teacher preferences in accomplishing the planning phases of the process. The team also agreed that time efficiency improved with familiarity of the LS PD process. When looking back over all three cycles, Mr. Klein felt more time out of class in cycle 1 was in order to become familiar with the LS PD model. He explained:

> You know I think that after looking back on it, the time spent after school and before school was a good thing because the last lesson helped speed it up. But, the more I think on it, the first lesson, the first time you do it, you need that whole day or you need that extra time where you do not have to worry about your classroom and then come in and do the lesson study after school.

Ms. Cote's responses in cycle 3 agreed with Mr. Klein in regard to additional time needed in cycle 1 and the need for flexibility in allowing teachers to choose meeting times that were best for them. Ms. Cote explained:

> If you are starting with a whole new crew, you do have to go through that first cycle a lot slower because they are not going to have it down like we do. You know they have to go through the process just like we did and talk about those goals you want to reach and you know maybe they don't mind missing all that class time because they want to take their time and be out of class to work on it together.

Ms. Chase agreed with the idea of teacher choice and added the importance of the group facilitator or administrator to guide the process and provide support. She described how you needed to "have a facilitator to kind of show you how to do it and support you and give you those days out of the classroom." Ms. Chase's comments regarding the importance of the team's facilitator segued into the second theme, *sustainment factors*, that emerged when investigating research question 3.

Sustainment factors. Unlike the first theme where participants tweaked the LS PD process, throughout each of the three cycles, to solve the major time constraint issues, theme two was simply a collection of ideas or sustainment factors that might support future implementation. The sustainment factors were supported by two categories in the data analysis: (a) support needed for sustainment and (b) staff buy-in needed for the purpose of scaling up the LS PD initiative. During the interview process, the participants keyed in on administrative support factors such as planning time,

commitment, and guidance. The LS PD team described how buy-in would be dependent on effectively communicating with potential participants, providing some degree of choice in participation, and appealing to the motivational needs of the potential participants.

Support. According to Mr. Klein, administrative support must come in the form of active participation and guidance. In other words, administrators or instructional leaders should fulfill the role of LS PD facilitator or expert who actively guided and supported the participants throughout the initiative (Lewis & Hurd, 2011). Mr. Klein also mentioned how administrators must ensure that the LS PD initiative was supported as a long-term or ongoing solution to the problem. Ms. Cote shared how it was important to have all administrators on board the initiative. She described how

> Having that facilitator as an administrator, making sure that things are going smoothly while they're in the meeting and going through the process and also being their facilitator helps them go through the observations. As long as if somebody is there doing it with them and they see that this is an important process, that will help them become effective teachers.

She also explained how it was important for administrators to serve as instructional leaders and facilitate the initiative, but it was equally important to value the administrative perspective as an active participant in the partnership between teachers and administrators and students. Ms. Cote stressed the importance of administration having long-term support and commitment for the initiative. She explained how staff members should be reminded of the importance of the LS PD initiative during regular

staff meetings. Ms. Chase agreed with her colleagues on the importance of administrative support that she described as being ongoing, consistent, and committed. Ms. Chase clarified: "I think that it just has to be kind of has to be consistent. We can't just do it one year and not do it next year. It is going to be long-term you have to keep it up."

Buy-in. Ms. Chase's long-term commitment segued into the vital role that administration plays in generating buy-in for any school initiative. Mr. Klein dovetailed this idea when commenting on the administrators' specific responsibility, stating:

> It can't be an initiative where you do it one year and you get a couple groups in and all of a sudden you bring in another new initiative. It has to be something, that if you want it to be long-term, it is something that you have to again get teacher buy-in.

Mr. Klein felt it was important that administrators also stress that the purpose of LS was to focus on student learning and not teacher performance that may cause participants to feel somewhat defensive or judged. He also felt that it was important for the participants in this initial LS PD initiative to provide testimonials as to the benefits of this approach to providing authentic growth opportunities for educators. Mr. Klein felt strongly that all teachers should be trained in lesson study and be required to participate in at least one cycle. He stated: "I think that all teachers are to be exposed, even if they take away a bad attitude. As a campus, we want to make sure that everybody has gone." Additionally, Mr. Klein felt that the LS PD model could become a district-wide initiative and, therefore, more sustainable if it were expanded to multiple campuses and grade levels.

Finally, Mr. Klein suggested that teachers would most likely be intrinsically motivated to participate in the LS PD initiative when hearing from peers with regard to the model's potential for self-improvement as an educator.

Ms. Cote also believed that one of the best approaches was to generate teacher buy-in through the testimonials of the current participants. She felt that would be a significant amount of intrinsic motivation where teachers would value LS for its focus on the students and potential to develop as teachers. She described some additional extrinsic motivators such as providing teachers time out of class for planning and extended lunch periods during the initiative as initial bonuses for participation. Unlike Mr. Klein, Ms. Cote felt it was important to work with interested volunteers as the initiative was scaled up. She explained how the administration should focus on willing volunteers and expand LS PD within the departments of the high school and eventually down to the middle school with the added benefit of cross-campus collaboration and vertical curriculum alignment. When discussing the positives of working with the middle school during student transitions from middle to high school, Ms. Cote hypothesized: "You know, maybe we could figure out some issues or come up with some strategies that could help us in the long run as the freshmen come up to biology."

Ms. Chase agreed with both of her colleagues on using teacher testimonials as methods for generating buy-in throughout the teaching staff. She also felt that teachers would be more inclined to be intrinsically motivated by LS as potential for making them better teachers, to better understand their students, considering the opportunity to collaborate on designing phase of or lessons. Ms. Chase was more in line with Ms.

Cote's thinking with regard to working with volunteers versus forcing teachers to participate in an LS PD initiative. Finally, she agreed with both of the other participants where expanding LS PD to multiple campuses in the district would promote long-term sustainability and buy-in. Ms. Chase described how she liked the "idea of working with other schools and kind of comparing how well we do with our objectives and they do with theirs and maybe seeing what they are doing that works and getting ideas from them." A significant number of the themes and categories shared by the participants were reinforced by the LS PD dissemination audience.

Research Question 4

What are the perceptions of the LS dissemination audience toward LS as a viable solution to a lack of quality PD for secondary biology teachers?

At the conclusion of three LS cycles, the participants led a final LS dissemination presentation where the team shared their experiences with the professional development model. The presentation included a basic overview of the problem of practice where there was a lack of quality professional development for secondary biology teachers, the process, and a brief discussion on the outcomes as they related to the goals and research questions for the initiative. The dissemination audience included high school teachers, science teachers from throughout the district, and administrators at the campus and district levels. After the presentation, the dissemination audience completed a questionnaire focused on exploring their perceptions relating to the initiative's goals and research questions that included (a) assessing the model, (b) exploring potential professional growth, and (c) developing a locally sustainable model.

Assessing the LS model. Although many of the audience members were hesitant to assess the model based on a single dissemination presentation, there was a theme that resonated with all teachers and all administrators: LS was valued for its use of collaborative observations in order to improve instruction. One elementary science teacher summed up her feelings toward the LS model as a viable solution stating: "I think it would be great to see how others present material to their classes and to learn new ideas." Another high school teacher commented on the depth of collaboration between teachers when compared to traditional PD: "This definitely addresses the need to make teachers researchers as opposed to students." An elementary principal commented: "This will assist in keeping the groups focused on the goal . . . . What that truly is and stay on track with what our focus instructional targets are." In addition to the collaborative observations for improving instruction, the dissemination audience also expressed a common concern for the amount of time the teachers would spend out of class and the number of substitute teachers that would be required to support the initiative.

Exploring potential professional growth. The dissemination audience shared a number of potential professional growth opportunities in areas such as differentiating instruction; however, collaboratively developing quality lessons encompasses the majority of the categories explored through constant comparative data analysis. Categories falling under the theme included database goalsetting, generally improving pedagogical approaches, learning from observing diverse teaching styles, and promoting curriculum alignment. One of the high school teachers shared: "I think that, from a

pedagogy standpoint and how it ties into district goals, it has great potential for professional growth." A middle school science teacher commented: "I feel like this model would help me understand what to look for with goalsetting in the lesson and observing other teachers teaching the lesson."

Developing a locally sustainable model. The common thought among all teachers and administrators with regard to developing a locally sustainable LS PD model was to address the time constraints imposed by the initiative. Audience members pointed toward the need for administrators to provide planning time, increased numbers of substitute teachers to cover classes during observations, starting with small groups of willing participants, and developing an efficient method for limiting the amount of time the teachers missed classes. One of the high school science teachers offered a potential solution: "I like the idea of one cycle per semester as it cuts down on the time constraint. I think administrative facilitation is important and may be staff with administrator's experience (certifications, masters' degrees, etc.) can serve as facilitators." Another science teacher suggested we focus on placing highly qualified substitutes in state-tested subjects: "Biology is a test subject. Use an IPC for chemistry teacher as a sub while the biology teachers are out of class." It is important to note that in addition to the common concern for time constraints, audience members pointed to a number of other needed sustainment factors, such as additional content support, videotaping future sessions for training purposes, and expanding LS across the campuses to increase sharing.

Discussion

This study employed a case study approach examining a three-cycle LS PD conducted in spring 2015. The experiences and perceptions of three biology teachers were explored. The goals for this study were to assess the LS model as a potential solution to a lack of quality professional development for secondary biology teachers, report on any relevant professional growth experienced by participants, and explore the development of a sustainable LS model within the local context. The participants in the study unanimously supported the LS PD model as a viable solution to the proposed ROS with specific value for collaborative observations and collaborative student-centered lesson design. The LS PD team members reported significant value in their professional growth experience in the areas of designing lessons from the students' perspectives and rediscovering the importance of checking for understanding in a variety of ways. Finally, both the LS PD participants and the dissemination audience were able to share specific sustainment factors that should be implemented in order to facilitate future implementation. The sustainment factors were categorized as needed supports, such as addressing time constraints, and promoting buy-in among all stakeholders.

Assessing Quality PD

In revisiting Darling-Hammond et al.'s (2009) attributes for quality professional development, including that it should be ongoing, comprehensive, collaborative, content-specific, coherent, and connected to practice, we can easily draw parallels to the LS PD model. LS is characterized as being ongoing where it allows teachers to develop quality lessons over an extended period of time. Whether LS PD teams are completing one or

three cycles, educators are engaged over a period of time in collaboratively researching the curriculum, redesigning the research-based lesson, presenting the lesson, re-examining and reteaching the lesson, and reflecting on their growth experiences.

LS is comprehensive, in fact that it allows teachers to study vertically while exploring prior and future learning with particular regard to potential student misconceptions and teacher responses. The model is collaborative in each and every phase of its design. LS is content-specific during both the planning or research phase as well as in the observation and critiquing phases where teachers examine lesson materials and student products. Coherence is addressed in the LS design where teachers within the same department work together to ensure alignment and pacing in the curriculum. Finally, LS's methodology provides participants with a live clinical approach to implementing quality PD. Participants in the LS PD model worked collaboratively with administration in an effort to improve instruction. This seemingly new idea of professional collaboration was amplified by Mr. Klein and Ms. Cote when they were asked to compare LS to traditional approaches to PD:

> **Mr. Klein**: When there is professional development where they try to make you the student, sometimes I don't like that. I don't like the professional development where all they do is give me more content knowledge. I'm pretty content knowledgeable. I don't need to be told about my subject. I just need to have some activities and stuff. But I don't want to be treated like a student either. So there is a fine line in professional development of that, and during the lesson study model

it wasn't like that. You know we studied the lesson and we were all treated as equals.

Ms. Cote: If you have the ability or have a chance to go to a secondary PD, it's . . . . A lot of it you feel like you're a student.

Exploring Professional Growth

The LS PD participants valued growth experiences in the areas of learning from developing lessons from the students' perspectives and rediscovering the importance of checking for understanding throughout the lesson. In other words, the teachers learned from the entire LS experience and not simply from designing a lesson. The entire experience of researching the curriculum and prior student performance, designing an interactive lesson, collaboratively teaching and observing the lesson, refining it, and reflecting on the experience allowed the participants to gain a greater appreciation for learning from the students perspective.

Lesson design from the students' perspective. Murata, Lewis, and Perry (2004) found similar results in a dual case study focused on examining instructional improvement through the collaborative refinement of existing lessons. The researchers found: "Although lesson study is sometimes described as a set of procedures for creating better lessons, the cases suggest it is better described as an interactive process of resource development and professional capacity development" (Murata et al., 2004, p. 7). In the current study, participants were able use the LS process to expand their professional capacity for examining quality lessons from the students' perspective. The interactive process of LS, as described by the participants, calls for proactive planning in

identifying potential misconceptions, preparing teacher responses to those misunderstandings, evaluating the points to notice during the observation phase, and addressing needed adjustments prior to the reteach phase. Ong, Lim, and Ghazali (2010) echoed the importance of proactively identifying misconceptions when anticipating student responses and stressed the importance of using focused scaffolding questions to minimize student misunderstandings during the lesson.

Rediscovering the importance of checking for understanding. The LS PD team also shared how the process helped them focus on student thinking and the importance of checking for understanding throughout the lesson. Lewis, Fischman, Riggs, and Wasserman (2013) reported similar results, crediting LS's approach to targeting specific points to notice during the design, observation, and debriefing phases of the process that increased the participants' professional capacities in eliciting and examining student thinking (Lewis et al., 2013). Participants in this study described how rediscovering the benefits of student dialogue in interactive activities such as warm-ups, group activities, and lesson closures helped them focus on student understanding and thinking during the lessons, which aligns with Marble's (2007) findings where teachers became more purposeful in designing opening and closing techniques. A review of the literature shows multiple studies in which participants reported a greater focus on the student as a benefit to participating in the LS resulting in increased proficiencies in teaching for understanding (Lewis et al., 2013).

LS Sustainment Factors

The LS PD team and the dissemination audience agreed that several sustainment factors needed to be implemented to ensure long-term success of the initiative. One common category called for providing support for significant time constraint issues. The second category focused on generating stakeholder buy-in.

Supporting LS. MVHS stakeholders overwhelmingly pointed to the need for administrative support in addressing significant time constraint issues including needed planning time and concerns for the substantial amount of time that teachers would be out of the classroom. Cajkler, Wood, Norton, and Pedder (2014) called for an adapted version of the Japanese Lesson Study model to be implemented in the United States in order to address the significant amount of time required to complete the process. Fernandez (2002) weighed in on the extensive amount of time needed for planning in observing during the LS process and encouraged schools to implement flexible professional development scheduling in order to find the time needed to commit to the initiative.

Additional time efficiency recommendations included having an agreed-upon curriculum for the purpose of coherence in providing expert facilitators to guide the process (Fernandez, 2002). Lim et al. (2011) acknowledged time constraints and suggested schools address related issues by eliminating conflicting initiatives, enlisting leadership support, recruiting teacher advocates, providing quality training and consider employing an LS expert facilitator. These recommendations are congruent with suggestions offered by the MVHS stakeholders. MVHS staff members discussed a

number of possible solutions to the time-constraint issues in proposing a locally designed LS PD model. The LS PD participants felt that LS PD orientation and other planning activities could occur prior to the start of the school year.

The team suggested that a full-day initial planning session should be dedicated to cycle 1 as future participants become familiar with the process. The participants unanimously agreed that two full days should be committed to the teaching and re-teaching phases of the LS PD process. The team clarified that the first teaching session should be held in the morning with the afternoon dedicated to critiquing and revising the lesson. On the day scheduled for the second teach, the morning would be dedicated to delivering the lesson and the afternoon would be reserved for completing final reflections and lessons learned.

The team also recommended that individual teams complete no more than one or two cycles per semester in order to allow other teams to work closely with leadership and to not overextend the school's limited number of substitute teachers. Finally, participants suggested that facilitators create a shared calendar in Microsoft outlook in order to coordinate multiple team activities. The LS PD dissemination audience agreed with the participants and added that highly qualified substitute teachers should be assigned to state-assessed courses as a first priority. MVHS stakeholders believed that implementing these recommendations might lead to greater buy-in among future LS PD participants.

Buy-in. As one would expect with any professional development initiative, studies report that buy-in is a critical element that should not be underestimated

(Chokshi & Fernandez, 2004). In this study, stakeholders identified numerous potential supporting factors that may promote buy-in for the LS PD initiative including support and long-term commitment by administration, quality training, a focus on instruction and not evaluation, teacher testimonials, opportunities to expand participation across the campuses, and opportunities for volunteerism versus forced participation. Although the LS PD participants agreed on the recommendation, there was a healthy debate concerning whether future participants would be required to complete at least one LS PD cycle or focus on willing volunteers.

> **Klein**: I think it's important. I think there should be some kind of campus initiative. To let everybody have the opportunity to go through it.
>
> **Cote**: Every teacher doesn't have to do it. Because if you're forced to do something you're not gonna enjoy it, or you're going to think that it is added work and added stress. But, if it's somebody that volunteers and said *yeah this is something I'm interested in trying*, then they should be able to have the same chances of doing it.
>
> **Chase**: Like she said (pointing at Cote), volunteers would be the best way to go. Because, if you're forced to do it, you're not going to do a good job of it because you would be hating it the whole time.

Mr. Klein then offered a compromise suggesting that "everybody has to be trained in the PD process. So it's not just the same as we did . . . but all of us just go through it." Ms. Cote and Ms. Chase agreed that all teachers should be trained in the process, but given the option of completing an LS PD cycle. Lewis, Perry, and Murata,

2006 (2006) described how spreading instructional improvement initiatives can take one of two routes: (a) a highly structured *general proof route* that may negatively impact buy-in or (b) a more flexible *local proof route* that allows for continuous adaptation. The LS PD team members opted for a combination of the two approaches. A *general proof route* could be used to introduce the LS PD model in a campus-wide introductory training session. The school could then shift toward a *local proof route* where volunteers choose to complete the LS PD cycle.

In completing an LS PD cycle, teams would have autonomy in selecting research-based lessons and adapting them to fit the needs of their particular students. In other words, buy-in may initially be negatively impacted when staff members are required to attend a LS PD orientation training; however, stakeholder buy-in may rebound when participants are given the option to complete an entire LS PD cycle. The LS PD dissemination audience suggested that results from quality training and support from administration would provide the best opportunity toward sustainment of the initiative. Although the LS PD team and dissemination audience agreed on the potential of the initiative to address the problem: Where there is a lack of quality professional development for secondary biology teachers, limitations of the study must be noted.

CHAPTER V

CONCLUSIONS

Limitations of the Study

Two common limitations in education research are related to sample size and study duration (Gay, Mills, & Airasian, 2003). Sample size limitations included the number of participants as well as their demographic backgrounds, organization type, and area of content expertise. Duration limitations included the length of the study and the number of LS PD cycles completed.

Sample Size

The number of participants for this study was limited to three teachers from the MVHS school campus. In addition to having all three teachers participating from a single subject area in a single high school, the male and female participants were all White. Middle Valley High School serves approximately 1,100 students and is classified as a medium-sized campus relative to other high schools in Texas. All three were biology teachers, which limited the teachers' perspectives with regard to potentially scaling up the LS PD initiative to include other content areas and grade levels.

Duration

This study ran the duration of one academic school year at MVHS. During the fall semester, the participants and other stakeholders actively engaged in identifying a problem of practice within the local school context that would ultimately be the focus of this ROS. Through a series of internship II activities and interviews, the stakeholders

agreed there was a problem of practice where there was a lack of quality professional development for secondary biology teachers. The team collaboratively explored the problem space, shared their values for quality professional development, and investigated the potential solution strategies based on the LS PD model. Findings from the internship II activities helped to inform my ROS that was implemented during the spring semester.

In the spring of 2015, the participants completed an orientation to the LS PD process and implemented three cycles of the LS model. The team completed one cycle per month in March, April, and May. During the first week of June, the team provided a LS PD dissemination presentation for an audience of administrators and teachers from elementary, middle school, and high school levels. The limited number of cycles, in such a short span of time, may have inhibited the efforts to capture the true essence of the participants' perceptions of lesson study.

Implications

Although the sample size and duration of this initiative was somewhat limited, the participants in this study and the dissemination audience felt that LS may be a viable solution to the problem of practice: a lack of quality professional development for secondary biology teachers. Moreover, LS appears to meet the criteria of Darling-Hammond et al.'s (2009) quality professional development that should be ongoing, comprehensive, collaborative, content-specific, coherent, and connected to practice. Secondly, participants were able to clearly articulate significant professional growth in the areas of designing student-centered lessons focusing on student thinking and

understanding. Finally, study participants and the dissemination audience were able to offer specific examples for developing and sustaining a LS PD model within the local contextual environment. The implication is that further study must be conducted in the areas of scaling up the initiative to include other departments and campuses in the district as recommended by the MVISD stakeholders.

The gradual scaling up of the LS PD model may positively impact the district from a global or universal perspective transcending departmental teaming and moving toward improving the overall instructional health of the organization. One specific area mentioned by the participants and the dissemination audience is a desire to improve instruction for students with special needs. Current research has supported the idea of pairing science teachers with special education teachers in order to gain a better understanding of the need for differentiated instruction for diverse learners (Mutch-Jones et al., 2012). A second potential area of study stemming from this study may be exploring the value of LS as a new teacher induction or mentoring program with the district. A review of the literature supports this notion where studies show that where LS can provide job-embedded professional development improving content knowledge, pedagogical best practices, and improving decision-making in the new teacher's classroom (Lim et al., 2011; Marble, 2006).

Although expanding LS throughout the district for the long-term future may be beneficial, best practices suggest that the school continue the pattern of starting small while sustaining the initiative through ongoing support by administration, allowing the

model to permeate throughout the district without overstretching resources. The district must carefully plan the *next steps* for scaling up and expanding the LS PD model.

Immediately following the LS PD dissemination presentation, my field-based mentor Mr. Neysmith (a pseudonym) suggested that we begin plans for scaling up an LS PD initiative. Recommendations for the *next steps* in the process come from conversations with my field-based mentor, the LS PD study participants, and the data gathered from the LS PD dissemination audience. This information, coupled with relevant literature informing the problem of the potential solution informed the process for moving forward.

Two guiding principles emerged from the literature with respect to scaling up the LS PD initiative while preserving resources and eventually developing buy-in from the stakeholders. The first guiding principle will be to expose the high school campus to an overview and orientation of the LS PD process. This would provide a highly structured *general proof route* where all high school teachers are exposed to the process as part of a required training. Once the teachers have been exposed to the LS PD process, a shift from the *general proof* to a *local proof route* can be made where participants are invited to volunteer to participate in a more in-depth study of the LS process (Lewis, Perry, & Murata, 2006).

The second guiding principle will be to move away from a traditional *Experimental Science Paradigm,* which mandates a rigid uncompromising implementation protocol for intervention programs, toward a more adaptable *Improvement Science Paradigm,* allowing for a customized approach to implementing

programs that meet the needs of stakeholders within the local contextual environment (Lewis, 2015). In other words, the basic principles of the LS would remain constant, including the orientation/training, research/planning, teaching/critiquing, and the re-teaching/summarizing of findings; however, participants would take ownership of the learning with regard to selecting lessons to study and choosing planning times that meet the needs of their demanding work schedule. Lesson selection will be coherent with individual and school improvement plans. Recommendations for implementing the *next steps* for expanding the LS PD initiative include:

- Summer: Provide a copy of *Lesson Study Step by Step: How Teacher Learning Communities Improve Instruction* by Lewis and Hurd (2011) to the high school staff members as part of a book-study kickoff.
- Staff development week (days 1-3): Provide a three-day LS PD orientation training for all high school teachers.
- Staff development week (day 4): Invite high school teachers and administrators who are interested in participating in future LS PD cycle implementations to attend and observe the opening planning session hosted by the veteran LS PD team. The team will collaboratively establish an implementation calendar for the fall semester.
- Fall semester: The veteran LS PD team and invited guests will implement one cycle with invited guests serving as outside observers (note: outside observers interact with the LS PD team during post-lesson discussions). The entire process will be videotaped for training and recruiting purposes. The

fall semester will conclude with a dissemination celebration where participants share their experiences during the fall semester luncheon. Outside observers will be invited to launch a spring lesson study cycle of their own.

- Spring semester professional development day (first day back): Veteran LS PD and former outside observers will kick-off planning for spring LS PD cycle implementation. Invitations will be extended to individuals who would like to participate as outside observers of the LS PD process for the first time. In addition to completing the research and planning documents, all participants will collaboratively design a LS PD implementation calendar for the spring semester.
- Spring semester: LS PD participants and outside observers will follow the fall semester protocol for implementing the process. An end-of-the-year dissemination celebration will be scheduled for the purpose of sharing testimonials and recruiting new participants for the fall semester. Invitations will be extended to other campuses to attend the dissemination celebration and receive an overview of the entire year's implementation process.
- Long-term activities: Consideration will be given to inviting LS PD teams to present their experiences at summer conferences such as the Texas Association of Secondary School Principals. Additional consideration will be given to the idea of inviting area schools to observe the LS PD process.

The findings of this ROS and the proposed *next steps* for moving forward suggest that long-term commitment and support for the LS PD model may significantly contribute to the overall instructional success of the Middle Valley Independent School District.

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APPENDIX A

LESSON STUDY ROLES

- Facilitator: Tour guide, time-keeper, member advocate, norms monitor.
    - Name:
- Note Taker/Typist: Records and distributes critical key points of the process.
    - Name:
- Recorder: Posts group talking points on chart paper to be kept in public view.
    - Name:
- Member: Participates in all activities
    - Name:
- Teachers:
    - 1st Teach:
    - 2nd Teach:
- Observer(s)

Guide to Developing Group Norms

What would make the lesson study group at a supportive and productive site for learning?

- Jot down a list of characteristics that are important to you. (It may help to think about characteristics of groups that you have functioned well or poorly to support professional learning in the past.) You may want to consider some general norms, such as listening and taking responsibility and some that have been identified as especially important to supporting learning of academic content, such as expressing agreement/disagreement and explaining your thinking.

- As a group, share and discuss the ideas generated by each number, taking particular care to identify and discuss any possible contradictions. For example, if one group member asked for safe and another for challenging my thinking, talk about how both can be honored.
- Synthesize members' ideas to a group list of about five key norms you all support.
- Record the norms for future reference.
- At the beginning of each meeting, choose one Norm to monitor that day. At the end of your meeting, discuss whether you upheld it and what can be improved.

Sample Protocols to Begin and End Each Lesson Study Meeting

Opening Protocol:

- Choose group rolls.
- Select a norm to monitor and briefly share ideas about what this Norm looks like.
- Review the desired outcomes or research theme for this year's work.
- Review the minutes from the last meeting.
- Review and revise today's agenda as needed.

Closing Protocol:

- Review key decisions made during the meeting.
- Agree upon assignments to be done by the next meeting and an agenda for the next meeting.

- Reflect on the norm selected to monitor today. Allow each member to comment on how they did in respecting the norm.

Choosing a Research Theme

Think about the students you serve. Jot down your ideas about each item before reading the next item.

Your Ideals:

Ideally, what qualities would you like these students to have 5 to 10 years from now (or alternately, when they graduate from your institution)?

The Actual:

List their qualities now.

The gap:

Compare the ideal and the actual. What are the gaps that you would most like to address as an educator?

The research team (the go, research focus, or main aim of this study).

By comparing the ideal and the actual student qualities, select a focus for your lesson study. State positively the ideal student qualities you choose to work on. For example, teachers and a Japanese school serving a low income, diverse community that had historically been subject to discrimination chose the following goal:

For students to develop fundamental academic skills that will guarantee their advancement and a rich sensibility about human rights.

Your research theme:

Teaching-Learning Plan Template

Team members:

Instructor:

Date:

Grade level:

1. Title of the lesson:

2. Research team (long-term goals), broad subject matter goals, lesson goals:

3. Lesson rationale: why we chose to focus on this topic and goals (for example, what is difficult about learning/teaching this topic? What do we notice about students currently as learners?) Why we designed the lesson as shown below: *(Potential factors: prior knowledge, review student products, review lesson materials, potential barriers/misconceptions, behaviors conducive to learning, peer interactions, student support for understanding, frequent checks for understanding)*

Guiding questions:

- *What topics are persistently difficult or disliked by students.*
- *What topics do teachers find most difficult to teach.*
- *In what subject areas do we see new curricula, frameworks, or standards that teachers want to learn / master.*

4. How does students understanding of the topic develop? For example, how does the lesson fit within a unit? How does it fit within students experiences in prior and subsequent grades?

5. Relationship of the lesson to state standards:

6. Lesson design:

7. Data collection points during the lesson observation.

- Our team will collect data on (*see #2 & #3 above; what do we want to evaluate?*):
- Outside observers are asked to collect data on (*student progress/failure; supports/barriers for learning*) :

Final Reflection Report Conclusion: What we have learned from this lesson study process? What did we learn from revising the lesson? What best helped students to learn the targeted objective?

Student Learning Activities (Transitions)	Anticipated Student Responses and Teacher Response	Points to Notice (evaluation)

Insert lesson plan here

Learning to anticipate observe and analyze student thinking

Learning to anticipate observe and analyze student thinking is a central part of lesson study. As teachers learn to view activity from a student's perspective and trace the students' process of knowledge development, many insights into the effectiveness of instructional strategies and tools become possible. Learning to see a lesson from the perspective of the student (not just the teacher moves and curriculum goals) is a paradigm shift for many teachers. We have often heard teachers comment during the post-lesson discussion of the research lesson, "if only we had anticipated the student responses, or done the activity ourselves, we would have seen the problem coming."

Teachers need to listen study often rush through or skip doing the activity students will do during the lesson. This is not surprising since we seldom have the luxury of trying out the activity ourselves to consider it from the perspective of students. However many important insights can be gained from this practice that will enable us to design a more effective lesson.

To anticipate student responses, we suggest the following steps:

1. Each member of the planning team should independently do the activity intended for the research lesson.
2. Give each member an opportunity to share how they approach the activity, and what they experience. Usually in a group of 4 to 6 teachers, there will be a variety of strategies. Teacher's responses will begin to shed light on how different students may approach the activity.
3. Imagine different students you know and discuss how they might experience the activity. What successes and difficulties will students encounter? What is a successful process and outcome for this task? How will you measure success?
4. The point of anticipating student responses is not to design the activity so that the students won't struggle or so that misconceptions won't emerge, but rather to give teachers an opportunity to plan how they will respond and to think about what kind of struggles and misconceptions maybe key to students learning during the lesson. Eliciting struggles and misconceptions can be an intentional elements of the lesson. Discuss the instructional strategies and options that facilitate student learning as struggles and misconceptions emerge.

5. If you adjust the lesson activity based on this exercise, try the lesson activity again to check again for anticipated student responses.
6. Record the anticipated student responses and teacher responses in the lesson plan. Document these adjustments in your lesson rationale.

Data collection guide

The following questions will help you identify the data to be collected by observers during the lesson:

1. What data will help you understand your students' progress on your lesson goals, broad subject matter goals, and long-term goals (research team)?
2. Would a prepared data collection form facilitate observation? (For example, a form that lists strategies you anticipate for a seating chart to record conversation pathways.)
3. What student work will be collected at the end of the lesson? (For example, an exit slip with a targeted question a student journal, or a piece of writing.)
4. How will material presented on the blackboard or in other venues be captured (for example, by observers, or by using the retaining chart paper)?
5. What are the individual assignments of the lesson study team? Will one person transcribe the lesson and keep a timeline of lesson events? Will observers be assigned to observe specific students or groups?

Lesson Observation Log

Title of lesson:

Goals of the lesson (From #7)

Observation objectives:

Time	Observation	Significance

Conclusions & *personal observations*:

Further questions raised:

First post-lesson discovery

- Post-lesson discussion (student thinking/learning focused) protocol:
    1. Instructor's reflections
        - Goals
        - Difficulties
    2. Team members report data
    3. Panel discussion of questions (questions from the audience)
    4. Audience discussion
    5. Invited commentator (optional)

Revising the Lesson

- Modify the lessons based on specific observations:
    - Worksheets
    - Materials/Manipulatives
    - Strategies/Grouping

Second teaching:

- Occurs two days after the first. The newest teacher delivers the less.
- Note: the teachers asked the students, from the first class, to share their findings in relation to the lesson.
- Listing for student conversations becomes critical

Second Post-lesson Discussion Protocol:

- Instructor reflections.
- Team members report data.
- Panel discussion of questions.
- Audience discussion.
- Invited commentator.

Final Reflection Report

- After the second post-lesson discussion, team members write a final reflection report on what they learned about teaching revising re-teaching the lesson.
- The report includes:
  - Recorded changes to the lesson.
  - Answers: what did we learn from revising the lesson?
- Recorders take notes on final reflections for the record.
  - What best to help students to learn the targeted objective?
    - We need to push more kids to explain the lesson.
    - Make the students think more.

APPENDIX B

EMAIL COMMUNICATION REGARDING THE IRB'S DECISION CONCERNING THIS STUDY

Begin forwarded message:

From: "Higgins, Catherine" <clhiggins@tamu.edu>
Date: July 10, 2014 at 7:56:14 PM CDT
To: Carol Stuessy <c-stuessy@tamu.edu>
Cc: "leblanc16@tamu.edu" <leblanc16@tamu.edu>, "burlbaw@tamu.edu" <burlbaw@tamu.edu>, Mary Margaret Capraro <mmcapraro@tamu.edu>, Bugrahan Yalvac <yalvac@tamu.edu>
Subject: RE: McHazlett-ROS Summary-Additional Information

Hi, Carol,

Given that this project fits within his scope of work as a needs assessment and quality improvement exercise and will not be used for generalizable knowledge, IRB submission, review, and approval is not needed. Let me know if any other information would be helpful.

Best regards,
Cathy

Catherine L. Higgins, Ph.D.
Manager, Human Subjects Protection Program and Institutional Review Board
Division of Research | Texas A&M University
750 Agronomy Road, Suite 2701, 1186 TAMU, College Station, Texas 77843-1186
Office: 979-458-4117 | Cell: 832-684-6462 | Fax: 979-862-3176
| clhiggins@tamu.edu | http://rcb.tamu.edu

APPENDIX C

RESEARCH INSTRUMENTS

Open Response Reflection Journal

(Participants) Please maintain a personal journal for the purpose of reflecting on your experiences throughout the LS initiative. You are welcome to make entries at any time during the process. We are asking for a minimum of one entry per LS cycle (x3).

APPENDIX D

ONE-ON-ONE SEMI-STRUCTURED INTERVIEW PROTOCOL

Position: _____ **Years of Experience: _____**

Campus Name: _____ **Time/Date: _____**

Participants will sit for a one-on-one interview with the researcher at the conclusion of each LS cycle (x3). Interviews are expected to run 30 minutes each (x3 biology teachers). Alternative questions will only be posed if the interviewee's response to the question will not suffice or it is unclear. Emerging questions may be posed during the conversation.

1. What are your feelings toward the LS model? (Alternative question: What do you think about the LS model as a PD activity for secondary biology teachers?)
2. What did you learn in the LS initiative? (Alternative question: What would you do different with the experience you have in the LS initiative?)
3. What would you have changed in the LS model you just participated to make it more attractive and sustainable for your future participation? (Alternative question: Would you volunteer participating at a future LS model? Why, and why not?)
4. Please tell me your other comments, questions, concerns, or suggestions about the LS model experience you had?

APPENDIX E

DISCUSSION GROUP INTERVIEW PROTOCOL

Participants

Position/experience

_____

_____

_____

_____

_____

_____

_____

Participants will gather for a focus group discussion with the researcher at the conclusion of each LS cycle (x3). Discussions are expected to run 30-60 minutes each (x3 biology teachers). Below questions will direct the conversation. Emerging questions might be asked and some of the below questions may not be posed.

1. What do you feel about the amount and quality of the PD activities for secondary biology teachers other than the LS model activity?
2. What do you think about the LS initiative?
3. What would you do different if you were to complete the same experience? Why, why not?

4. What are your feelings toward the LS model as a viable solution to a lack of quality PD for secondary biology teachers?
5. What are your perceptions in regard to your professional growth as a result of participating in the LS initiative thus far?
6. What improvements to the LS PD model might facilitate long-term sustainment of this initiative?
7. What is your most significant takeaway from this discussion?

APPENDIX F

POST LS INITIATIVE DISSEMINATION QUESTIONNAIRE

Final dissemination audience members will complete the following questions relating to Goals I-III of the LS PD study.

Position: _____ **Years of Experience: _____**

Campus Name: _____

The post LS dissemination audience will complete the following questionnaire.

1. What are your feelings toward the LS model as a viable solution to a lack of quality PD for secondary biology teachers?
2. What are your perceptions in regard to your professional growth as a result of participating in the LS initiative thus far?
3. What improvements to the LS PD model might facilitate long-term sustainment of this initiative?
4. Do you have other comments, questions, concerns, or suggestions?