Using Japanese Lesson Study to Merge Inservice Professional Development and Preservice Clinical Experiences

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Abstract:

For many years, lesson study has been woven into the professional lives of Japanese teachers. Recently, it has become more widespread in the U.S. Core elements of Japanese Lesson Study include collaborative lesson design, empirical trials of lessons, collective analysis of empirical trials, and subsequent lesson re-design. We describe how these core elements were implemented in a teacher education project that brought together prospective and practicing secondary-level science and mathematics teachers in interdisciplinary groups facilitated by university faculty members. The four groups described in this report designed and analyzed lessons about attending to scale factor in the context of microscopic images, constructing a geologic timeline, examining states of matter, and building a scale model of the solar system. The Japanese Lesson Study process helped these groups reflect on the nature of the content being taught, pedagogical concerns, and content-specific pedagogy. We found that discursive moves such as connecting separate strands of conversation and identifying mistakes helped facilitate group reflection. A growing body of research suggests that Japanese Lesson Study can be implemented in a wide array of contexts; we encourage others to include it among clinical experiences for prospective teachers because of its potential to give more undergraduates access to the most skilled mentor teachers and to counteract feelings of professional isolation that cause many to leave teaching. We offer our own experiences facilitating lesson study and dealing with challenges along the way to help others start to implement the model in their own professional settings.

Key Words: Japanese Lesson Study; collaboration; reflection; pre-service teachers; professional development

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An essential element of school-university partnerships that support pre-service teacher preparation and in-service teacher professional development is "A shared commitment to innovative and reflective practice by all participants" (National Association for Professional Development Schools, 2008, p. 3). In such partnerships, key participants include practicing teachers, future teachers, and university faculty members. Finding ways to bring these individuals together to actively engage with one another, reflect on practice, and learn through reflection is an ongoing challenge. We have found that Japanese Lesson Study (JLS) provides one useful structure for bringing these key participants together for professional development driven by reflection on teaching practice (Lewis & Hurd, 2011).

In this article, we begin with an overview of JLS and its potential benefits. We then describe the JLS structure we used for science and mathematics teacher education in a school-university partnership. Some of the types of reflection on practice the JLS structure fostered are then recounted. We close with thoughts on directions for continuous improvement of the structure and its use in other settings.

JLS and its Benefits

Historically, lesson study has been part of the fabric of teacher professional development in Japan (Stigler & Hiebert, 1999). Over the past two decades it has steadily become more prominent in the U.S. (Lewis, 2016). Lesson study consists of cycles of setting goals for student learning of a central idea within the school curriculum, collaboratively planning a research lesson to address the goals, conducting the research lesson while lesson study group members observe and gather classroom data, and holding a debriefing session to analyze the research lesson's

effectiveness in supporting students' learning (Figure 1, Lewis & Hurd, 2011). The debriefing session may lead to further refinement of the lesson during another cycle of lesson study, or it may lead to formation of a new, related lesson. The purpose of lesson study is not necessarily to build a large library of ready-made lessons, but to provide a structured setting for teachers to build and refine their knowledge for teaching.

<INSERT FIGURE 1 HERE>

During its introduction in the U.S. over the past two decades, the research base for JLS has grown steadily. It has been shown that lesson study can improve teachers' content knowledge (Lewis, Fischman, Riggs, & Wasserman, 2013; Lewis, Perry, & Hurd, 2009; Watanabe, 2002), pedagogical knowledge (Fischman & Wasserman, 2017; Sibbald, 2009; Xu & Pedder, 2015), and pedagogical content knowledge (Cajkler, Wood, Norton, & Pedder, 2014; Huang & Shimizu, 2016). Teachers participating in lesson study have increased their confidence and self-efficacy for teaching (Chong & Kong, 2012; Rock & Wilson, 2005) and have become more curious about students' thinking (Lewis et al., 2013). Lesson study helps build teacher communities by fostering collegiality (Taylor et al., 2005) and collaboration (Cajkler et al., 2014; Xu & Pedder, 2015). Professional learning communities built by participating in lesson study can become self-sustaining and survive beyond the term of a specific grant or project (Doig & Groves, 2011; Hunter & Black, 2011; Lewis et al., 2009). Hence, existing research supports the idea that JLS can play a key role in bringing educators together to enhance partnerships dedicated to reflection on and improvement of practice.

Our Structure for JLS

Given the robust research base supporting JLS, we used it to enhance an existing school-university partnership for teacher preparation. As part of a grant-funded project, we assembled

four lesson study groups that each had 5-6 individuals. Each group had an experienced school-based mentor teacher, undergraduates who were prospective teachers, and a university faculty mentor (one of the co-authors of this report). Our project focused on improving the teaching of mathematics and science by integrating the two subjects. Each school-based mentor teacher had extensive experience teaching secondary level mathematics or science. Mentors were given stipends as compensation for the outside-of-school hours spent organizing lesson study group meetings. Participating undergraduates who were in their first two years at the university received stipends to participate; our hope was that seeing lesson study in action would encourage them to enter or finish our secondary teacher education program. Undergraduates at the junior level were given scholarships that were contingent upon their participation in the lesson study process and completion of a secondary mathematics or science teacher education program.

Each group was given the task of completing one lesson study cycle (Figure 1) per semester. To begin their work, each group met multiple times to plan lessons integrating mathematics and science in meaningful ways. After agreeing on their plan, each group taught their lesson and video recorded it. Students' written work from each lesson was retained for analysis. The videos were uploaded to a secure private streaming platform (www.vimeo.com) accessible only to lesson study group members. Each group member used annotation tools available on the streaming platform to insert comments about the strengths of the lesson and how it could be improved. Each group then met for debriefing sessions to discuss the comments they had posted, compile lists of strengths and areas for improvement, and revise their lessons for future use.

Over the entire life of our project, we plan to conduct lesson study during four consecutive academic years. In this report, we concentrate on findings and lessons learned during

our first semester of implementation in order to provide insight to those aiming to begin their own lesson study collaborations. During our first semester, each of our groups designed and implemented a unique lesson. Group 1 taught a lesson on scale factor and its role in studying objects observed under a microscope. Group 2 focused on helping students create a representation of Earth's historical timeline to indicate when various geologic events of the past occurred. Group 3 guided students in understanding states of matter, phase changes, and connections to everyday phenomena such as the water cycle. Group 4 aimed to help students describe the scale of the solar system using real world models and observe the distance between planetary bodies. Next, we report on the types of reflection that were sparked as groups engaged in planning these four lessons and critically analyzing their implementation.

Types of Reflection on Practice Fostered by the JLS Structure

The debriefing phase of lesson study provided opportunities for extended reflection among group members. Debriefing session conversations contained a number of themes related to the content of the lesson, general pedagogy, and content-specific pedagogy. Opportunities for discussions pertaining to these categories are important because content knowledge, pedagogical knowledge, and pedagogical content knowledge are vital aspects of the knowledge base for teaching (Hill, Ball, & Schilling, 2008; Shulman, 1987); these categories of teachers' knowledge develop as they encounter and resolve classroom-based problems (Mewborn, 1999). Salient themes from our lesson study debriefing sessions related to each of the three categories are summarized in Figure 2 and described in detail next.

<INSERT FIGURE 2 HERE>

Debriefing sessions included attention to how content was represented for students. Group 3, for example, wrote about how they used vocabulary in explaining the water cycle in the following exchange:

> Mentor teacher: By now, students have heard the words condensation, evaporation, precipitation, collection, and boiling being discussed for the same portion of the graph, and the more general term vaporization was never used. It might be good to have sorted through some of this vocabulary earlier in the lesson and agree on the verbiage so we could keep it consistent.
>
> Undergraduate: I very much agree with this, while most of them have one explicit term, vaporization is often used interchangeably with boiling and evaporation even though they are not the same thing. I also believe we should just pick one and stick with it. As for the other terms like precipitation and collection I think they should be used exclusively for the water cycle portion.

Along with this strand of conversation, Group 3 also critiqued the axis labels for a graphical representation of phase changes they used in the lesson, deciding it would be more accurate to call the horizontal axis "energy" rather than "energy added." These types of conversations had the potential to help lesson study group members clarify and refine their own content knowledge as they decided how best to portray the content of the lesson.

Some other strands of conversation pertained to general pedagogical concerns. Lesson study group members talked about their use of time during the lesson, the amount of student engagement, assessment techniques, and supporting classroom conversations. Group 1, for example, considered ways to get materials in place more quickly and efficiently to make the best use of class time. They also considered saving time during the lesson by having students read

background and instructions in advance. Group 2 considered using a timer to manage the amount of time spent on each lesson segment. Group 4 noticed that it was a challenge to keep all students engaged during some parts of the lesson and suggested a solution to the problem, stating,

> There was a handful of students that stayed very engaged even at the end of the lesson when the measuring was more difficult. While this is an accomplishment next time we should maybe put more of an emphasis on passing the meter sticks around to the whole group rather than having the same students do the measurement repeatedly.

Group 3 talked about how their extensive use of large-group discussion limited their opportunities for assessment of individual students' thinking during the lesson. To solve this problem, one Group 3 undergraduate suggested,

> A think-pair-share would have given all students an opportunity to address the questions we were asking. It would have also given us an opportunity to hear what all students were thinking as we walked around the room.

Group 3 also discussed how calling on students by name could help improve classroom conversations; they decided to put nameplates on students' desks so all group members teaching the lesson would be able to do so. Debriefing session themes of this nature directly addressed many day-to-day concerns of lesson implementation that cut across lessons and content areas.

Other debriefing session themes addressed issues related to content-specific pedagogy. Lesson study groups discussed anticipating students' thinking about content, selecting appropriate questions and tasks, sequencing lesson events, and teaching materials. Undergraduates in Groups 2 and 3 shared that they were at times caught off-guard by students' thinking. One group 3 undergraduate, for example, was surprised that students already knew the answers to many of the questions she asked them about the water cycle. When Group 1 noticed

that students had difficulty reasoning proportionally about dimensions observed under a microscope in relation to actual dimensions, their university faculty member suggested emphasizing the idea of "zooming" more extensively in setting questions and tasks. The group then decided to question students about their experiences zooming in and out on things like cameras, iPads, and Google maps to help activate the knowledge they would need for tasks requiring analysis of microscopic images. In regard to sequencing lesson events, Group 1 decided to have students examine microscopic images under increasingly greater magnification rather than in a random order of magnification, and Group 2 decided to change the order in which students placed events on a large geologic time scale to encourage groups to reason on their own rather than duplicating responses of others. Necessary improvements to teaching materials that groups discussed included higher-quality microscope slides for onion cells (Group 1), color-coded cards for events to more readily trace where groups of students placed them on a large geologic time scale (Group 2), and having a pre-made unit of measurement such as perforated toilet paper squares to measure units in a scale model of the solar system (Group 4). These conversational themes helped lesson study groups collectively identify ways specific content aspects could be portrayed more vividly for students.

Challenges and Directions for Continuous Improvement

Although our lesson study groups reflected on important teacher education themes, we faced some challenges along the way. A central challenge for those facilitating lesson study is to stimulate conversations without taking over. Lesson study is not a top-down model of professional development; instead, the goal is for lesson study group members to take control of their own learning. This ideal can be especially difficult to achieve when lesson study group members are slow to make contributions or fail to reflect on pivotal points in a lesson. Beginning

teachers, in particular, are vulnerable to focusing only on their own teaching actions rather than students' learning (Santagata, 2011), concentrating on general pedagogical concerns when delving into content-specific pedagogy would be more advantageous (Stockero, 2013), or not going beneath the surface to examining the reasoning underlying students' correct and incorrect responses (Simpson & Haltiwanger, 2017). When such tendencies emerge, it is important for facilitators or other group members to intervene, but not dominate, the conversation.

From our experience, we can offer some examples of conversation moves that pulled multiple participants into discussions about important issues. One such move was to explicitly connect separate threads of conversation. An example of this occurred in Group 3's work. When watching the lesson video, the university faculty member for the group noticed that students on one side of the room seemed to be disengaged. The faculty member then suggested a resolution to this dilemma by noting how the group's earlier conversations about making nameplates for students and not relying solely on students who volunteered responses were relevant to this portion of the video; student nameplates would allow teachers to explicitly call on students to re-engage them in the lesson. Undergraduates agreed with this assessment of the situation and its resolution, and they made plans to implement the adjustments when teaching the lesson again in a future lesson study cycle. Each undergraduate talked about how they could make similar adjustments to the segments of the lesson for which they were the lead teacher. This episode illustrates how drawing upon ideas already introduced can leave the group in control of its own learning while still moving the conversation forward.

Another potentially productive conversation move is to point out challenges and mistakes made during a lesson. This, of course, must be done with care. To lay the foundation for such conversations, it is important for lesson study groups to explicitly acknowledge that making

mistakes is a normal part of the learning process. Research supports the notion that making and correcting mistakes is one of the most powerful ways to learn, not just for students, but also for teachers (Boaler, 2016). Unanticipated challenges often arise during teaching. JLS is inherently about continuous improvement, so groups should expect to identify things that can be improved in any given lesson. Group 1's work provided an illustrative example. The mentor teacher for the group noted that the onion cell slides were not of high enough quality for students to see clearly. The undergraduate in charge of preparing the slides acknowledged this observation and that the slides needed to be of better quality for the next lesson. The undergraduate went on to start productive conversations about other elements of the lesson that could be improved, such as sequencing student work stations in order of increasing magnification. In group 4, undergraduates took the initiative to identify how student engagement and instructional materials could be improved as they annotated the lesson video. During the debriefing session, they talked about the need for advance testing of materials used for lessons. In order for lesson study to succeed, it is important for group members to develop the community norm of acknowledging and addressing mistakes rather than shying away from discussing them.

Implementing JLS in other Settings

As demonstrated in literature cited earlier (e.g., Fischman & Wasserman, 2017; Lewis et al., 2013; Sibbald, 2009; Watanabe, 2002; Xu & Pedder, 2015), JLS has been implemented in a wide array of settings, and is by no means limited to the setting we have described. One unique aspect of our setting is that we were able to support lesson study group participants with grant funds. Given the robust research base for JLS, using it as part of a project can help secure similar grant funding, but such funding is not absolutely necessary. Institutions might consider using resources already allocated for supporting clinical experiences to help JLS take root. Having

prospective teachers do JLS as part of already existing clinical experiences has a number of advantages. First, it provides prospective teachers a vision of how teaching can be a collaborative effort, counteracting the feeling of isolation that causes many to leave teaching (Schlichte, Yssel, & Merbler, 2005). Being part of a group made the initial teaching experience less intimidating for some undergraduates. During a debriefing session, one undergraduate in our project commented that she was more comfortable teaching collaboratively rather than individually. Second, it allows more prospective teachers to benefit from working with the best mentors available in a school setting. Rather than being a one-to-one mentor to undergraduate relationship, JLS allows for productive, manageable one-to-many mentor to undergraduate ratio. Third, it portrays teaching as a process of continuous improvement, during which both mentors and interns can learn, rather than positioning the mentor's teaching as a perfect model to be emulated. Given such benefits, it is worth considering JLS as a requirement for at least a portion of the clinical experience time prospective teachers are already required to complete.

Conclusion

Constructing hypotheses, testing them by gathering empirical data, analyzing the data, and constructing new hypotheses and questions to answer are inherent to the process of scientific investigation. JLS positions such activities as central to the process of learning to teach as well. Lesson study group members have opportunities to support one another as they engage in evidence-based examination of practice (Lee & Tan, in press). As they do so, they can form communities of practice tightly focused on improving instruction. Although such communities do not form without considerable effort, we hope others will experiment with JLS in their own settings, and we also hope that the experiences and advice we have provided will help in such endeavors.

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Figures

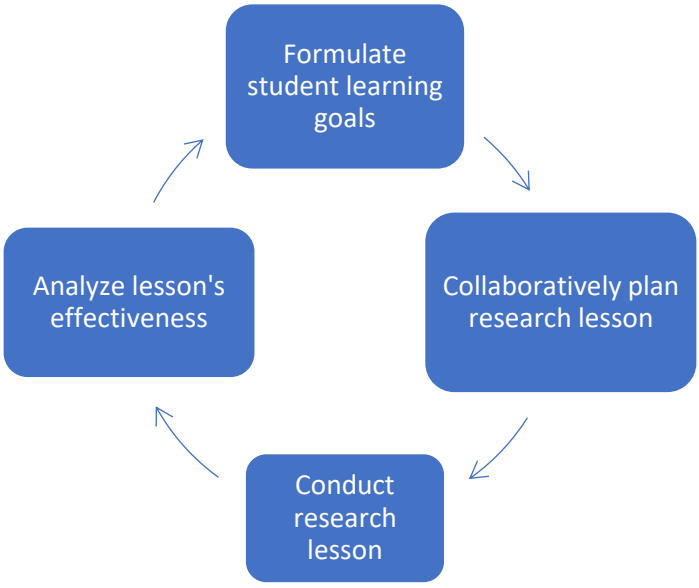

Figure 1. Lesson Study Cycle Components

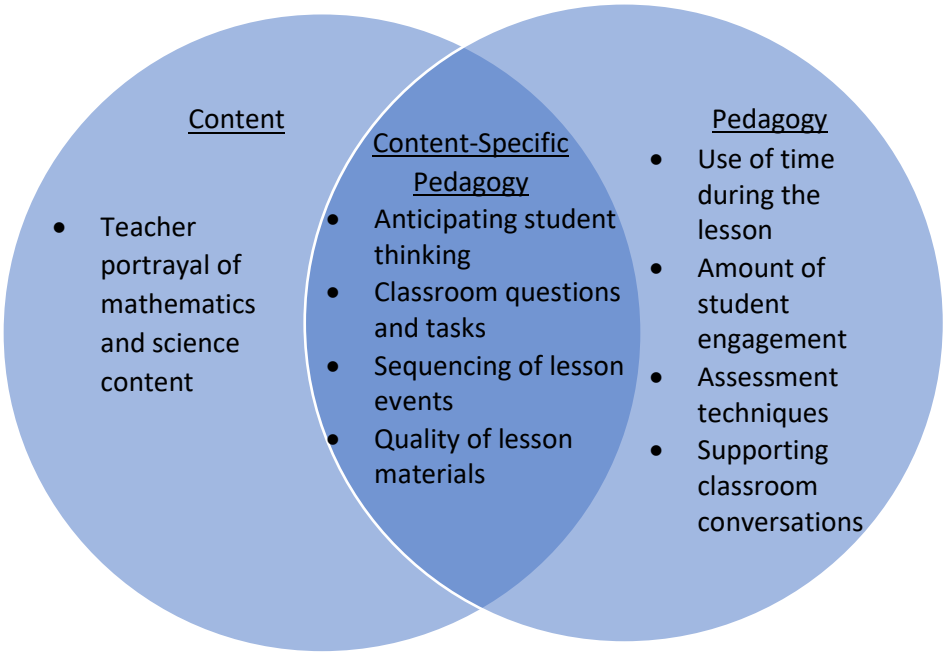

Figure 2. Salient Conversational Themes from Lesson Study Debriefing Sessions