

Cooper, S., Wilkerson, T. L., Eddy, C. M., Kamen, M.,
Marble, S., Junk, D., & Sawyer, C. (2011). Lesson study
among mathematics educators: Professional collaboration
enabled through a virtual faculty learning community.
Learning Communities Journal, 3, 21-40.

Lesson Study Among Mathematics Educators: Professional Collaboration Enabled Through a Virtual Faculty Learning Community

Sandi Cooper
Trena L. Wilkerson
Baylor University

Colleen McLean Eddy
University of North Texas

Michael Kamen
Stephen Marble
Southwestern University

Debra Junk
The University of Texas at Austin

Cameron Sawyer
Massey University
(New Zealand)

A group of mathematics educators worked together to implement the lesson study model as a professional development strategy while teaching their methods courses. The idea of collaborating across universities to engage in a professional development opportunity by forming a professional learning community created an appealing challenge. Because the group members were teaching in different institutions (and, in one case, a different country), however, they could not meet face-to-face on a regular basis. To overcome this obstacle, the group formed a "virtual community" by using various technology formats for communication. This article describes the experiences of the

group, including unique benefits and unpredictable challenges of forming a virtual faculty learning community.

Teaching and learning are inextricably linked. Yet higher education faculty are often challenged to identify and engage in effective, appropriate professional development that allows us to participate in activities to study this link, examine our own teaching, and determine the impact of instruction on student understanding. This is particularly exigent if one is the only faculty member within a specific discipline at an institution or is the only faculty member teaching a course in a specific field of study. In addition, most faculty in higher education are not trained to study their own teaching or investigate student learning (Cerbin & Kopp, 2006). Attempting to collaborate or participate in professional development with faculty from different institutions makes this effort more complex.

It is this distinctive situation that brought together a group of seven higher education faculty representing five different higher education institutions. Most of us taught the same course, methodology in mathematics for elementary education majors, at our respective institutions, and we were generally the only one teaching that course at our institution. This isolation within our own institutions, along with a common interest in examining our own practice, provided the impetus for us to collaborate. Our intent was to pilot a particular professional development model, Japanese Lesson Study, that focused on our own teaching practice while, at the same time, engaged the use of new technologies to develop and foster a professional learning community at a distance.

Adopting Lesson Study

Through a collaborative process, our small group of higher education faculty worked together to form a professional learning community to implement a professional development approach called *Japanese Lesson Study* to our teaching. Japanese Lesson Study (generally referred to as just "Lesson Study") is a professional development approach that encourages teachers to work together to plan lessons, observe each other's implementation of the planned lesson, and make changes based on what is observed to improve the lesson (Lewis & Tsuchida, 1998). The majority of this type of professional development occurs in Japanese elementary schools, and there are several ongoing Lesson Study professional development endeavors throughout the United States (Fernandez, 2005; Fernández, 2008; Lewis, 2009; Lewis, Perry, & Hurd, 2004; Lewis, Perry, & Murata, 2006). Some researchers argue that lesson study is the type of teacher profes-

sional development that can help establish a usable knowledge base for teaching (Hiebert, Gallimore, & Stigler, 2002).

As individual faculty, we had been engaged in lesson study cycles in our work with either inservice or preservice teachers and had seen the benefits for those engaging in this process. Levels of collaboration among teachers had strengthened, content knowledge had been deepened, and personal understanding of the importance and relevance of reflective practice was evident. Our group decided that Lesson Study would be a good process to explore for our professional development. In the cases previously reported, most lesson study groups involved K-12 teachers working in the same building or same school district. As a group of higher education faculty all teaching in different institutions in different locations, then, we were faced with a challenge.

When we began our work, a literature review did not reveal any model of higher education faculty implementing lesson study as a professional development tool. Later, the group learned that the University of Wisconsin - LaCrosse had been implementing lesson study as a professional development tool within its university setting since fall of 2003 (Cerbin & Kopp, 2006). Participants in the "College Lesson Study Project" there reported that they had benefited from the careful analysis of learning goals, study of teaching practices, and observation of student thinking. In addition, these participants shared that discussions with colleagues related to teaching and learning had been most valuable. Presently, more higher education institutions are utilizing this professional development approach (Alvine, Judson, Schein, & Yoshida, 2007; Becker, Ghenciu, Horak, & Schroeder, 2008; Bogner, 2008; Saito, Hawe, Hadiprawiroc, & Empedhe, 2008).

Christiansen, Klinke, and Nielsen (2007) pointed out that lesson study could serve as a method for instructional change for higher education faculty and be particularly useful in developing the idea of teaching as a community effort rather than an individual endeavor. The authors further asserted that there is a need for university faculty to share not only knowledge related to pedagogical principles, but also experiences related to creating the best learning opportunities for students. An underlying principle of Lesson Study is that teachers need to understand how their students learn in order to provide effective instruction (Lewis, 2005). According to Lewis (2009) lesson study impacts development of teacher knowledge, interpersonal relations, and personal qualities and dispositions such as curiosity, personal identity as a learner, and motivation to improve. Other Lesson Study leaders concur that participation in lesson study supports the development of content knowledge (Fernandez, 2005;

Fernández, 2008). Furthermore, the significance of community development among educators is paramount when engaged in lesson study (Alvine et al., 2007; Fernandez, Cannon, & Chokshi, 2003).

The idea of collaborating to participate in a professional development process was of interest to all of us. Our group included six faculty members from mathematics education departments (two of whom taught secondary education courses and served as outside participants) and one faculty member who was from a mathematics department and worked with education students, but also served as an outside participant. In addition, there was one faculty who served as an outside consultant, and, at the time, he was located in another state (Hawaii). Most of the team was located in the central part of the same state and were within driving distance of each other (not more than 1.5 hours drive), and they were willing to travel for face-to-face meetings and lesson observations. Another member of the group was located in a city about 300 miles away from the others but was willing to travel (a short, one-stop flight) to meet the group for planning and for most observations. However, the other members of the group were not able to travel to observe this team member's two lessons, so technological options needed to be organized for the group to participate. Thus, the group worked to form a "virtual community" by utilizing various formats of technology for communication. This collaborative process began the organization of our professional learning community to facilitate our professional development through Lesson Study.

Defining Professional Learning Communities Within Higher Education

Professional development in higher education is a relatively new field of study with limited research on professional learning communities. Knight, Tait, and Yorke (2006) concluded, through a number of studies at their institution, that faculty in higher education reported on their professional development in ways that emphasize "non-formal" learning. They further purported that although there is still a place for "event-based educational professional development," these experiences usually complement, rather than supersede, "situated social learning" (p. 320).

Cox (2004) has defined a Faculty Learning Community (FLC) as a "cross-disciplinary faculty and staff group of six to fifteen members . . . who engage in an active, collaborative, yearlong program with a curriculum about enhancing teaching and learning and with frequent seminars and activities that provide learning development, the scholarship of teach-

ing, and community building” (p. 8). Vaughan (2004) learned through a survey of faculty involved in FLCs that 90% of respondents were using some form of technology to support their learning community. However, through a more focused pilot study conducted with a small group of faculty, he learned that “the ongoing face-to-face sessions allowed personal relationships and a sense of community to develop,” but the technology supported a more individual reflective process (p. 105). Thus, in the case of this faculty group, the combination of face-to-face and virtual meetings provided both the establishment of personal relationships and a sense of community with opportunities for individual reflection.

For our purposes, professional learning communities are identified as either communities of practice or virtual communities. A community of practice involves a group engaged in traditional face-to-face interactions with equal accountability and contribution to the group. Virtual communities involve group interactions through technology with limited face-to-face interactions.

Communities of Practice

DuFour and Eaker (1998) asserted that groups should embrace a new model for school improvement that enables them to function as learning organizations. They indicated that the term “community” emphasizes relationships, shared ideals, and a strong culture. According to DuFour and Eaker, a professional learning community has the following characteristics: (1) shared mission, vision, and values; (2) collective inquiry; (3) collaborative teams; (4) action orientation and experimentation; (5) continuous improvement; and (6) results orientation.

Most professional development in higher education related to classroom instruction with college students has involved peer observation. While feedback from peers is beneficial, this does not constitute a professional learning community, where all participants are held equally accountable for the instruction in the classroom. Peer observations are often met with skepticism because instructors fear the observations will be utilized as a judgment on their teaching (summatively) and not for their developing as an instructor (formatively) (Shortland, 2004). In some cases, peer observations have been utilized as a requirement for training graduate students to be college instructors (Peel, 2005).

Learning circles, another form of professional development in higher education that support communities of practice, are designed to organize a group of faculty with a common goal in a community of practice. Erklenz-Watts, Westbay, and Lynd-Balta (2006) described how their in-

terdisciplinary learning circle developed a common goal of improving student engagement. Each participant was held equally accountable in the group by being responsible for leading a seminar on student engagement and reflecting on how aspects of the topic could be situated into practice. This small group of participants (~10) were successful in meeting during the summer for the seminars, but they were not as successful with the completion of observations, in which each participant attempted to implement best practices of engaging students. While this group was initially successful in building a professional community, they were unsuccessful in sustaining the community. Perhaps they could have benefited from transitioning to a virtual community in the fall.

Virtual Communities

A virtual learning community has been described as an extension of the physical learning community outward to an electronic format (Wenger, 1998). Lock (2006) indicated that a virtual or online community involves a group who meet regularly through an online venue to share specific goals and interests. There have been a number of studies (Presteria & Moller, 2001; Shrivastava, 1999) providing evidence that a virtual learning community is a powerful tool to promote online learning participation. According to Rovai (2002), a virtual learning community can be defined in terms of four dimensions: spirit, trust, interaction, and commonality of goals (learning). Similar definitions of virtual learning community (Kowch & Schwier, 1997) suggest that an essential framework for a virtual learning community comprises an active learning environment that fosters a climate of learning in community; a dynamic learner-directed process of "communication, collaboration, interaction, and participation" (Lock, 2002, p. 397); and the development of feeling or sense of community. In addition, Lally and Barrett (1999) discussed the strategy of using computer-mediated communication to reduce transactional distance and facilitate the construction of learning communities in an online environment.

One form of virtual community is collaborative journaling, which includes both personal and professional reflection (Alterio, 2004). In Alterio's (2004) study of this approach, however, participants lacked a common profession and remained anonymous to each other. This impeded the development of an authentic professional learning community because participants were unable to collaborate, discuss, and relate to demands that were unique to their profession. Participants in this study also lacked a personal connection because they never met and did not reveal their identities to each other. This lack of personal connection inhibits develop-

ing a sustainable long-term professional learning community.

In our attempt to organize a professional learning community, it was helpful that most of the members of our group had worked together in various capacities prior to the formation of this Lesson Study team. Because all team members were actively involved in the mathematics education community, we had many previous interactions during national and state conferences, professional meetings, and other professional development events. Our established relationships provided an initial sense of community and clearly supported our efforts to create an effective “virtual learning community.”

Organizing Lesson Study

During Lesson Study, teachers develop goals for student learning, work collaboratively on “research lessons” to bring the goals to life, document and discuss student responses to these lessons, and, in the process, revise the lessons in response to student learning (Lewis, 2002; Lewis & Tsuchida, 1998; Stigler & Hiebert, 1999; Yoshida, 1999). Lesson Study is appealing to teachers because it engages them in the selection, study, and solution of a problem that they find personally valuable. Instead of relying on external measures of validity or controlled experimental studies, lesson study involves teachers in a process of studying student learning, engagement, and behavior during actual classroom lessons in their own schools (Lewis, Perry, & Murata, 2003).

There are three key phases in the Lesson Study process (Lewis, 2002) that allow groups to engage this professional development approach. The first phase of this process is the *planning phase*, in which participants plan a lesson together. During the *observation phase*, the group observes each other teaching the lesson and documents their learning experiences. In the final *reflection to revision phase*, groups participate in a debriefing session to share observations, ask each other questions, and make possible revisions for the next iteration of the lesson. For our Lesson Study process, our group scheduled lesson-planning dates, communicated via e-mail to refine the lesson plan, and made travel arrangements to attend these lessons face-to-face as well as use various technologies when face-to-face was not feasible. In addition to participating in each other’s lessons, our group made plans to conduct the final lesson during a national conference that would be held in a city within their home state. Communication was essential in organizing these events, making plans for activities, and sharing reflective thoughts with each other. The formation of a virtual community

allowed our group to stay in close contact, further develop the design of the lesson, and coordinate efforts for implementing the lesson.

Planning Phase

For each phase of the Lesson Study we employed various available technologies to help maintain the true spirit of the actual process. In the *Planning Phase*, the group utilized both face-to-face and electronic formats. The original planning phase was completed face-to-face; then, as planning continued, we used e-mail correspondence. This allowed for a fluid, dynamic process of planning and discussion related to student learning the content focus area we identified. The group continued the use of e-mail and instant messaging capabilities to reflect on our observations, share observation notes, and exchange revised lesson plans, teaching materials, and our student preservice teachers' work. These electronic messages were saved as text files and archived in our overall data set, which was managed by one person but made accessible to the group. This combination of face-to-face and technology-supported communication combined the formation of a community of practice with a virtual community.

Observation Phase

In the *Observation Phase*, the initial lessons we taught were observed in face-to-face presentations. One member of the team taught the lesson, and all others observed the lesson. Each team member observed a specific group or individual student or focused on an aspect of the lesson structure, such as questioning, dialogue, or use of instructional materials. The observation areas were discussed and then assigned during the *Planning Phase*. Each observer took notes that were shared in the *Reflection Phase* described in the next section. There were times as the lesson was revised and then taught again by another group member that an individual Lesson Study team member would be unable to attend the real-time observation, so lessons were video recorded. These video-recorded episodes also provided documentation for reflection and data analysis for all team members. One lesson was taught at a time that none of the other team members could physically attend; videoconferencing was utilized again to provide documentation for future reference. The lesson could be observed in real-time as well.

Reflection to Revision Phase

During the *Reflection to Revision Phase*, after the initial lessons were

taught, the team members who were present for the observations also met face-to-face for the reflection sessions that followed each lesson. In these sessions, revisions were made to the lesson for future implementation. These sessions were audiotaped for documentation and data analysis. Reflection and discussion continued through e-mail. When lessons were observed via videoconferencing, the reflection process continued through this venue as well as use of instant messaging. All electronic data were collected by two team members and then shared with the other members.

Implementing Lesson Study

To begin our lesson study, the group met face-to-face in a central location to plan a common lesson for our methods courses and to develop a strategic plan for observations. We decided to develop a lesson on invented strategies in two-digit multiplication. One faculty member in the group had taught a similar lesson, so she brought some experience and specific ideas to this planning process. Other members of the group shared their experience and insights related to the chosen topic of study. Our group continued to refine this lesson after this initial meeting via e-mail interactions. In addition to planning the lesson, our group set specific dates for each group member to teach this lesson and for the others to participate as observers.

First Iteration

The first lessons were taught during a one-week time period to allow our group to maximize their designated travel time to observe each other. Although the planning group was located within one state and most were located in relatively close proximity, distance options needed to be explored for the one faculty member who was located in another city in the state that was quite a distance (~350 miles from the others) and was not feasible for others to travel. Working with her college technology coordinator, she made arrangements for her fellow faculty members to observe the lesson at a distance by using videoconferencing (iTV) via the Internet.

To maintain the normal climate of the class to be observed, a mobile videoconferencing unit was brought into the classroom where students had met throughout the semester. In most videoconferencing situations, students must attend class in designated videoconferencing rooms. Because this lesson was only to be *observed* by our group, however, the use of the interactive component of videoconferencing was not required, thus

allowing the college students to remain in their “normal” classroom. This maintained a familiar learning environment.

Using videoconferencing (with a web camera) via the Internet, our group was able to observe the lesson from the computers in their offices. In the event they wanted to ask a question, make a comment, or indicate there were technical difficulties, they used an instant messaging system (MSN Instant Messaging program) to communicate with the technology coordinator. As in face-to-face observations, however, the members of our group were required only to observe and take notes, not to interact with the instructor or students. At the conclusion of the lesson, the group communicated in a debriefing session using the instant messaging system. The instructor was still available through videoconferencing via the Internet so that others could “hear” her responses. However, others in the group had to type their questions and comments using the instant messaging system, and the technology director then had to convey this information to her. At the conclusion of the lesson, the entire group had an opportunity to debrief by asking questions via the instant messenger and continued video input. The entire group was invited via the instant messaging into a single IM session, making the environment more analogous to an online chat.

Second Iteration

The next iteration of this faculty member’s lesson was video recorded, saved as a DVD, and mailed to our group. The debriefing session did not occur until much later because of the time constraints of our group. Since the lesson was video recorded and available in DVD format, our group was able to view the video and take notes as their schedules allowed. It was not until the group began to analyze all of the data that a time was set for debriefing and all actually studied the video.

Final Iteration

The final iteration of this lesson was conducted during a national conference held in the group members’ home state with preservice teachers from a nearby university. In order to plan this session effectively, our group communicated via e-mail and instant messaging. The conference session format presented some new challenges, but the experience allowed our group to explore additional insights presented by new “members” collaborating with the team. Although many conference sessions are designed for participants to sit and listen, this innovative format allowed participants

actually to participate in a portion of the lesson study process. After a short presentation on lesson study, an overview of the group's recent implementation, and group discussion, the preservice teachers were invited to participate in the planned lesson. The conference participants observed the lesson and participated in the debriefing session following the lesson. This session was also video recorded to allow our group to study it more in depth at a later time. In addition, one member of the Lesson Study learning community was unable to attend the conference but was able to view the video-recorded lesson later for analysis and reflection.

Supporting Virtual Communities in Lesson Study

The use of various technologies to support the professional development of our learning community of mathematics educators offered some benefits along with certain challenges. With the capability of "broadcasting" a lesson via videoconferencing, we fellow faculty members had the option of observing the lesson at a distance, from the comfort of our offices, using our computers. We, too, did not have to make arrangements to use a videoconferencing room or get the videoconferencing connections required. Our group was set up on an instant messenger program on our computers in order to communicate with the technology director at the remote site during the lesson observation. We could indicate if there were problems with sound, if the camera needed to zoom in on particular students, or if some information needed to be clarified. This made text-based interactions richer and more free flowing, because all geographically separated participants could see the questions being posted by others at different locations.

The video footage of the observed lesson was automatically recorded and immediately archived so that the lesson could be viewed from the same Internet location after it was completed. In the event one of the faculty members could not observe during the actual lesson time, he or she could readily observe it as soon as possible. In addition, faculty members who had observed the lesson "live" could review it if needed. The instant messenger dialogue easily could be saved as a text document to include with this archived video lesson.

The use of technology provided us with documentation in the form of audio and video recordings, instant messaging logs, and transcripts from the audio and video lesson recordings. These records provided opportunities to revisit our initial goals, planning decisions, the actual lessons, and lesson debriefing sessions. From the very first lesson presentation, one significant observation made by the Lesson Study group members was

the lack of engagement on the part of student peers when selected students were presenting their teaching strategies in the class. During these explanations, several students were not paying attention, were working on other tasks, or were engaged in conversations that were off task. Thus, in subsequent iterations, the lesson was modified to require that when the students were presenting their strategies, the other students in the classroom were to observe and analyze critically the strategies presented by the students. The video documentation and debriefing transcripts of these lessons supported this initial assertion, as this portion of the lesson was improved.

A distinct advantage with the video-recorded lessons was that each group member could review sections multiple times to capture certain elements. This is not possible in a face-to-face classroom, in which it is possible to see only where one is looking at any given time. Being able to review and study the clips provided a more in-depth observation of essential elements of the lesson and conversations.

Identifying the Challenges for the Virtual Community

When observing a lesson in person, we had the opportunity to sit among the students in groups and listen to their discussion and responses. But observing at a distance only allowed us to observe the group as a whole, and, because of audio technicalities, we could listen only to whole-group interactions, with little or no ability to distinguish individual student dialogue. To address this limitation, the instructor from the remote site had a few graduate students attend the lesson, sit with the groups of students, and record their responses. The graduate students participated in the debriefing so that “at a distance” faculty members could ask questions about the students’ responses. In addition, the graduate students’ notes were transcribed and shared with our group.

If one of the community members could not participate in the “live” observation of the lesson, he or she could view the lesson at a later time and read the debriefing transcript; however, that person could not participate in the “live” discussion with the others. In an attempt to address this limitation, our group planned a common time that worked for everyone to participate in a discussion via the instant messenger system. This format allowed everyone to ask questions, make comments, or clarify interactions about the lesson observed. However, our group expressed the concern that the intent of the Lesson Study process may have been compromised because of our varied involvement level. After this experience, the group felt that this concern needed further study in order to examine the effects

of “virtual participation” and how this impacts the intent of lesson study as a form of professional development.

Because the educational institutions from which each lesson study participant connected to the online videoconference were members of the Internet2 consortium (a high-performance network partnership, see <http://www.internet2.edu>), available bandwidth for these connections was robust. If individuals and institutions not connected via Internet2 were to be involved in videoconferencing Lesson Study connections, available bandwidth could be a limiting factor. Networks with firewall restrictions on instant messaging or streaming video also could impede connections. If local network architecture includes quality of service (QoS) protocols giving priority to videoconference connections, bandwidth limitations could be less of an issue. Fortunately, in the case of this pilot project, robust bandwidth was available, and firewall restrictions were not present to impede the seamless connection of participants to both the live, web-based video stream as well as the instant messaging dialogue.

Some challenges were present in regard to the video-recorded lessons that were provided to our group in DVD format after the lesson was implemented. In some cases, it was several months before many of us viewed the lesson, so that the episode was not as fresh for our group. The DVD was mailed to group members, many did not make time to review as soon as they received it, and busy schedules made it difficult to plan a debriefing session in a timely manner. Therefore, the debriefing session could not be conducted as intended and served only as a review of the entire process. Despite this delayed review, our group continued to communicate via e-mail and IM to make plans for the national conference presentation and to organize the next cycle of Lesson Study. The group acknowledged, however, that a video-recorded lesson was not as effective as the live videoconferencing option for observing lessons as a distance.

Maintaining the Virtual Community

The distance issues we mentioned earlier prompted our group to learn to use various electronic formats for more effective communication. Although we faced challenges with learning to use instant messaging, observing video conferencing, and viewing video-recorded lessons, these options allowed our group to communicate on a regular basis, thus forming and strengthening our virtual community. Forming this virtual community of learners was the only option that allowed our group to participate in the Lesson Study process.

As mathematics educators, we all shared similar goals and experiences

that allowed us to form personal connections that supported a long-term professional learning community. As Alterio's (2004) study demonstrated, this personal connection is key to an "authentic" professional learning community. In fact, spirit, trust, interaction, and commonality of goals, the four dimensions of an effective virtual learning community according to Rovai (2002), actually were developed by our group prior to the formation of our professional learning community. Our prior working relationships, common goals, and similar roles as faculty all contributed to our functioning effectively as a virtual community.

Our need to use formerly unfamiliar technology, such as instant messaging, resulted in new insights for some of the team members. A few team members reported using instant messaging in other, unrelated professional collaborations. In addition, based on this experience, our group became more willing to explore other unfamiliar technologies that may allow us to continue this work as we make plans for future cycles of Lesson Study.

As with every use of technology, there were times that the technology itself proved problematic. Connections that were dropped during video streaming via videoconferencing or during instant messaging are examples. However, it was characteristic of our group to be patient, willing to explore new options, and dedicated to our continued work together. Well after all of the face-to-face and virtual meetings and observations, our group has continued to work together to plan a second cycle of Lesson Study via electronic communication, thus maintaining our virtual community of learners. With the exploration of other technology options for conducting Lesson Study, our group plans to continue to examine the effectiveness of virtual communities for professional development. Rapidly growing available technology with features that allow for more online collaboration continues to advance the possibilities for professional learning communities to consider.

Murata and Takahashi (2002) have pointed out that Lesson Study incorporates features associated with effective professional development, including a focus on meaningful problems, an examination of the contexts of teaching, and onsite collegial support. At the same time, it avoids many of the inadequacies of traditional professional development, such as short term, fragmented, and externally administered events. Cerbin and Kopp (2006) assert that Lesson Study provides opportunities for higher education faculty to work on significant issues and ideas related to teaching and learning. They point out that although participants design a single lesson in this process, what they learn from the experience can be applied to other lessons and, possibly, to other courses.

The faculty members in our group have reported continued benefits from our efforts to engage in professional development through Lesson Study. Some of us have continued to use the lessons developed through this process with preservice teachers in the mathematics methods courses they teach each semester. In addition, we have initiated or continued to organize the Lesson Study format with classroom teachers or preservice teachers in K-12 school settings. The group has maintained communication as a virtual community to continue collaborations related to this project. Additionally, various combinations of group members have collaborated on other research projects, making use of new technology to support their work.

A Powerful Learning Experience

Although the organization of this professional development learning community was a challenge, we found that our collaboration was a powerful experience that exceeded our expectations and pushed us to new understandings about our students and ourselves. Overcoming the challenges of distance and isolation enabled us to share insights into the development of a lesson and the purposes of preservice instructional activities.

Based on reflections written by all group members, this professional development strategy has provided a powerful learning experience in many ways. One group member pointed out that our discussions were different from typical conversations with fellow faculty in his department. Discussions with the Lesson Study group focused on sharing ideas and strategies and provided new insight about how student outcomes should drive instructional decisions. Another group member shared that this lesson study process was more than just planning a lesson together. The focus was on students' thinking and how best to prepare an effective lesson that would develop reflective practitioners. The feedback from team members was not focused on "the teacher," but on the effectiveness of the lesson process that all team members had "ownership" of because the planning had occurred together.

One group members reflected on the differences between the face-to-face observations and the iTV synchronous video experience. She shared that the face-to-face observations provided an opportunity to "listen in" on the small-group discussions, to hear how discussions related to the actions and connections between the instructor and the student, and to be able to view the student work displayed to better assess student understanding. She pointed out, however, that the use of the iTV synchronous video

allowed her to participate in other lessons that she would not have been able to otherwise because of travel and time constraints. Although it was difficult to hear all of the group dialogue in the videoconference, it still gave this team member a view into the classroom and an opportunity to listen to a different group of preservice teachers as they engaged in a modified lesson. Also, an advantage of this format was that participants could go back to review and study clips for more in-depth observations.

Several of the group members commented on the effectiveness of studying a lesson together. One of us shared that she found such value in hearing the perspectives of 3-5 other instructors who had just viewed the same lesson. Another indicated that this process really helped them learn more about what it takes to help engage students in a lesson at a deeper level. One of the group members, who joined the group just as an observer, shared, "I discovered that there is room for all levels of participation, and it is not necessary for every participant to design and teach in order for Lesson Study to influence practice."

Next Steps

In the second iteration of this Lesson Study process, the group decided to forgo most of the travel and attempt to observe lessons from a distance. However, for the planning and first lesson observation, the entire group traveled to a central location for face-to-face interactions. For the subsequent lessons, the group utilized various options for videoconferencing, including a web camera and computer made available in their regular classrooms. During one lesson location, we used Elluminate, the videoconferencing program supported by the university, while at another university location we used Skype. During the observations, the observers could "chat" with the facilitator using the options available for each program. The debriefing sessions followed the lesson observations, using the same technology. While this method allowed us to eliminate some travel, it did create some limitations that we have recognized as areas for improvement. For example, we found it difficult actually to observe and listen to students' interactions and responses. However, because these lessons are recorded, they can be transcribed and made available for continued examination.

Sustaining virtual communities for high-quality professional development needs to be carefully planned, and the selection of technology clearly impacts how these communities can be fostered (Lock, 2006). As our group considers future options, some of the newer technology available has the potential further to enhance the ability to maintain this virtual

community and invite others to join. According to the *Horizon Report* (Johnson, Levine, Smith, & Stone, 2010), an increasing number of faculty are experimenting with mobile computing for collaboration and communication. Although most of the current applications being explored—such as lectures via podcast and course materials in electronic formats—are related to instruction, the potential for using various mobile computing options for communication could lead to a higher level of collaboration. The use of *Dropbox* for sharing files, *FaceBook* or *Twitter* for group “blogging” or “journaling,” and *Skype* for videoconferencing all have promise for developing or expanding these powerful connections. For the next cycle of Lesson Study, our group is considering the use of *GoogleWave*, a web-based communication protocol designed to merge e-mail, instant-messaging, and social networking. As a group, we learn more and more each day about how the latest technology might support our continued efforts to collaborate as a virtual community of learners.

References

- Alterio, M. (2004). Collaborative journaling as a professional development tool. *Journal of Further and Higher Education*, 28 (3), 321-332.
- Alvine, A., Judson, T. W., Schein, M., & Yoshida, T. (2007). What graduate students (and the rest of us) can learn from lesson study. *College Teaching*, 55 (3), 109-113.
- Becker, J., Ghenciu, P., Horak, M., & Schroeder, H. (2008). A college lesson study in calculus, preliminary report. *International Journal of Mathematical Education in Science & Technology*, 39 (4), 491-503.
- Bogner, L. (2008). Using lesson study as an instrument to find the mental models of teaching and learning held by career and technical education instructors. *The International Journal of Learning*, 15 (1), 239-244.
- Cerbin, W., & Kopp, B. (2006). Lesson study as a model for building pedagogical knowledge and improving teaching. *International Journal of Teaching and Learning in Higher Education*, 18 (3), 250-257.
- Christiansen, F. V., Klinke, B., & Nielsen, M. W. (2007). Lesson study as a format for collaborative instructional change. *Pharmacy Education*, 7 (2), 183-185.
- Cox, M. D. (2004). Introduction to faculty learning communities. *New Directions for Teaching & Learning*, 97, 5-23.
- DuFour, R., & Eaker, R. (1998). *Professional learning communities at work: Best practices for enhancing student achievement*. Bloomington, IN: National Educational Service.
- Erklenz-Watts, M., Westbay, T., & Lynd-Balta, E. (2006). An alternative

- professional development program: Lessons learned. *College Teaching*, 54 (3), 275-279.
- Fernandez, C. (2005). Lesson study: A means for elementary teachers to develop the knowledge of mathematics needed for reform-minded teaching? *Mathematical Thinking & Learning*, 7 (4), 265-289.
- Fernández, M. L. (2008). Developing knowledge of teaching mathematics through cooperation and inquiry. *Mathematics Teacher*, 101 (7), 534-538.
- Fernandez, C., Cannon, J., & Chokshi, S. (2003). A US-Japan lesson study collaboration reveals critical lenses for examining practice. *Teaching & Teacher Education*, 19 (2), 171-185.
- Hiebert, J. Gallimore, R., & Stigler, J. W. (2002). A knowledge base for the teaching profession: What would it look like and how can we get one? *Educational Researcher*, 31 (5), 3-15.
- Johnson, L., Levine, A., Smith, R., & Stone, S. (2010). *The 2010 Horizon Report*. Austin, TX: The New Media Consortium.
- Knight, P., Tait, J., & Yorke, M. (2006). The professional learning of teachers in higher education. *Studies in Higher Education*, 31 (3), 319-339.
- Kowch, E., & Schwier, R. (1997). Considerations in the construction of technology-based virtual learning communities. *Canadian Journal of Education Communication*, 26 (1), 1-12.
- Lally, V., & Barrett, E. (1999). Building a learning community on-line: Towards socio-academic interaction. *Research Papers in Education Policy and Practice*, 14 (2), 147-163.
- Lewis, C. (2002). *Lesson study: A handbook of teacher-led instructional change*. Philadelphia, PA: Research for Better Schools.
- Lewis, C. (2005). How do teachers learn during lesson study? In P. Wang-Iverson & M. Yoshida (Eds.), *Building our understanding of lesson study* (pp. 77-84). Philadelphia: Research for Better Schools.
- Lewis, C. (2009). What is the nature of knowledge development in lesson study? *Educational Action Research*, 17 (1), 95-110.
- Lewis, C., Perry, R., & Hurd, J. (2004). A deeper look at lesson study. *Educational Leadership*, 61 (5), 18-22.
- Lewis, C., Perry, R., & Murata, A. (2003, April). *Lesson study and teachers' knowledge development: Collaborative critique of a research model and methods*. Paper presented at the annual meeting of the American Educational Research Association, Chicago, IL.
- Lewis, C., Perry, R., & Murata, A. (2006). How should research contribute to instructional improvement? The case of lesson study. *Educational Researcher*, 35 (3), 3-14.
- Lewis, C., & Tsuchida, I. (1998). A lesson is like a swiftly flowing river:

- How research lessons improve Japanese education. *American Educator*, 22 (4), 14-17, 50-52.
- Lock, J. (2002). Laying the groundwork for the development of learning communities within online courses. *Quarterly Review of Distance Education*, 3 (4), 395-408.
- Lock, J. V. (2006). A new image: Online communities to facilitate teacher professional development. *Journal of Technology and Teacher Education*, 14 (4), 663-678.
- Murata, A., & Takahashi, A. (2002). Vehicle to connect theory, research, and practice: How teacher thinking changes in district-level lesson study in Japan. In *Proceedings of the annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education* (pp. 1879-1888). Athens, GA: University of Georgia Department of Mathematics Education. (ERIC Document Reproduction Service No. ED 471 780)
- Peel, D. (2005). Peer observation as a transformatory tool? *Teaching in Higher Education*, 10 (4), 489-504.
- Prester, G. E., & Moller, L. A. (2001). Exploiting opportunities for knowledge-building in asynchronous distance learning environments. *Quarterly Review of Distance Education*, 2 (2), 93-104.
- Rovai, A. (2002). Building sense of community at a distance. *International Review of Research in Open and Distance Learning*, 3 (1), 2-16.
- Saito, E., Hawe, P., Hadiprawiroc, S., & Empedhe, S. (2008). Initiating education reform through lesson study at a university in Indonesia. *Educational Action Research*, 16 (3), 391-406.
- Shrivastava, P. (1999). Management classes as online learning communities. *Journal of Management Education*, 23 (6), 691-702.
- Shortland, S. (2004). Peer observation: A tool for staff development or compliance? *Journal of Further and Higher Education*, 28 (2), 219-228.
- Stigler, J. W., & Hiebert, J. (1999). *The teaching gap: Best ideas from the world's teachers for improving education in the classroom*. New York: Free Press.
- Vaughan, N. (2004). Technology in support of faculty learning communities. *New Directions for Teaching & Learning*, 97, 101-109.
- Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity*. New York: Cambridge University Press.
- Yoshida, M. (1999, April). *Lesson study [Jugyokenkyu] in elementary school mathematics in Japan: A case study*. Paper presented at the annual meeting of the American Educational Research Association, Montreal, Canada.

Sandi Cooper is an associate professor of mathematics education in curriculum and instruction at Baylor University. She teaches courses in the undergraduate and graduate program in mathematics education. Her research interests focus on the development of mathematical thinking in young children and how various instructional strategies, contexts of learning, and use of technology can enhance mathematical connections. Her research projects include the study of the integration of math and science, integration of children's literature in mathematics, how informal learning opportunities enhance mathematical thinking, impact of families in math and science learning, preservice teachers' understanding of children's mathematical thinking, and professional development through lesson study. **Trena L. Wilkerson** is an associate professor in the department of curriculum and instruction in the School of Education at Baylor University. She teaches undergraduate and graduate courses in mathematics education and directs projects aimed at encouraging students to continue postsecondary high school education through focused summer camps and activities in mathematics education. Her research interest include the study of geometric and rational number thinking in young children, the use of lesson study in mathematics teacher professional development, and understanding the impact of engaging undergraduate students in research on their practice and mathematical content knowledge. **Colleen McLean Eddy** is an assistant professor of mathematics education in teacher education and administration at the University of North Texas. She teaches mathematics education courses and conducts professional development workshops for secondary mathematics teachers. Her research interests include improving mathematics instruction through curriculum development, implementation of best practices, and teacher quality. **Michael Kamen** is an associate professor in the education department at Southwestern University. He is editor of the *Electronic Journal of Science Education*. He teaches courses in the elementary and middle school certification program and the Bachelor of Arts program, including Mathematics Methods, Science Methods, Educational Technology, Classroom Organization and Management, and Innovative Schools. His research interests include Japanese Lesson Study as a model of professional development, creative dramatics in science education, and applications of Vygotskian theory. **Stephen Marble** is an associate professor in the education department at Southwestern University. He teaches undergraduate courses in the secondary teacher certification program and directs a summer on-campus residency for Latino high school students who intend to attend college as first-generation college-bound students. His research interests include incorporating lesson study experiences into methods classrooms, promoting academic literacy, and conceptualizing the implications of the philosophy of Giles Deleuze on teaching and learning. **Debra Junk** is the coordinator for mathematics initiatives at the Texas Regional Collaboratives at the University of Texas - Austin. She coordinates the program activities for mathematics professional development Mathematics and Science Partnerships grantees across the state. Debra continues to teach preservice and inservice teachers about cognitively guided instruction. Her research interests are mathematical knowledge for teaching and mathematics professional development. **Cameron Sawyer** works for the College of Education at Massey University in New Zealand. She teaches courses in primary mathematics education and provides professional development for teachers in secondary mathematics, which has included using Lesson Study with teachers within one school and across schools.