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Lesson Study at the Bank Street School for Children

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by

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Abstract

Lesson study, the primary form of professional development in Japan, is receiving increased attention in the U.S. Its efficacy in Japan is well documented, and it has been successfully implemented in the U.S. Other educator-scholars have adequately argued for its use in American schools. What is needed, however, is more documented evidence of its implementation and outcomes, as well as school-specific frameworks for conducting lesson study in various schools, especially independent schools. There has been extensive documentation of lesson study in public schools across the U.S., but none, as we know, in independent schools. This paper establishes a framework for and analysis of lesson study at one independent school, Bank Street School for Children.

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"Lesson study is a simple idea. If you want to improve instruction, what could be more obvious than collaborating with fellow teachers to plan, observe, and reflect on lessons?" (Lewis, 2002)

Introduction

The primary form of professional development for American schoolteachers is workshops and seminars, but in Japan teachers improve their teaching through "lesson study," a process in which teachers jointly plan, observe, analyze and refine actual lessons. These "research lessons" are thus finely tuned, dynamic, and effective. Moreover the *process* is widely credited with improving teacher instruction in Japan, specifically in mathematics and science: Japan has consistently ranked in the top 5 on the Trends in International Mathematics and Science Study (TIMMS) since 1995, the first year the study was conducted, (National Center for Education Statistics, www.nces.ed.gov/Timms/results.asp), and educators there and elsewhere credit 'lesson study',' among other factors, as a significant factor in the educational outcomes of Japan (Mastrull, 2002; Lewis, 2002; Lynn, 1988).

In the last decade, since Catherine Lewis's pioneering paper of 'lesson study', a number of educators have implemented the Lesson Study approach to professional development and lesson planning in the U.S. These initiatives are, however, few and far between, and have not, as of yet, become a primary form of teacher development in the U.S. Nor has Bank Street School for Children, a leading independent school in the U.S. and a working model of Bank Street College's approach to learning and teaching, tapped in to the potential of Lesson Study.

Bank Street College is a leader in progressive education, with a rich tradition grounded in the values and philosophies of Lucy Sprague Mitchell, John Dewey, Lev

Vygotsky and others. Education at the School for Children, an independent demonstration school for Bank Street College, is experience based, interdisciplinary, and collaborative; "the emphasis is on educating the whole child – the entire emotional, social, physical, and intellectual being – while at the same time the child's integrity as a learner, teacher, and classmate is valued and reinforced" (About the School for Children, http://bankstreet.edu/school-children/about-sfc/). The School has 435 students in grades Pre-K through Eight, with two classrooms of 17-25 students in each grade and a student to teacher ratio of 8:1. Teachers at the School are concerned with helping children become not just good learners but good people; rather than extrinsic rewards or punitive consequences, there is an emphasis on collaborative problem solving, the idea of students as self-regulating human beings and productive members of a democratic society, and intrinsic motivation. Students play an active role in their own learning, which is organized around questions, problems and projects; skills matter, but only in an authentic context and for a purpose. Teachers "invite [students] to think deeply about issues that matter to them and help them understand ideas form the inside out" (Kohn, 2008, p. 4).

While there is much the School does right and can celebrate in its education of children, the School has yet to tap into the potential of lesson study as a teacher-driven form of professional development. Indeed, its teachers are one of the School's greatest assets; and yet, teachers do not plan, observe, analyze or refine their lessons cooperatively in any formal or substantive fashion. As a second year teacher in the 5th Grade at the School, I decided to implement a model 'lesson study' with the 4th-8th grade Math/Science teachers, the Upper School Learning Specialist, and my

advisor, course instructor in mathematics in the Graduate School. In this paper I argue that Japanese Lesson Study provides a model for effective, sustainable professional development at Bank Street School for Children. What follows is a rationale for implementing lesson study at Bank Street School for Children, a framework for its application, and a review of this pilot lesson study.

What is Lesson Study?

Makato Yoshida, founder of Global Education Resources, first coined the term "lesson study" in his doctoral dissertation. Derived from the Japanese word *jugyokenkyuu*, meaning "research lesson," it is a form of professional development aimed at improving instruction. More specifically, lesson study is the process of planning, conducting, and discussing research lessons (Lewis, 2002). It is teacher-initiated, teacher-driven; it is collaborative, and it is an on-going process. The four key components that lead to instructional improvements are: " (1) a shared long-term goal for teachers; (2) important lesson content; (3) careful study of students; and (4) live observations of lessons" (Lewis, 2002). What this looks like in practice is a group of teachers with a shared goal coming together to design a lesson, implement that lesson, collect data on its delivery and student learning, discuss the data and refine the lesson to increase learning outcomes. What is unique about 'lesson study' is that teachers base the lesson design on their ideas about how students learn; teachers observe student learning when the lesson is taught; they analyze observations of student learning after the lesson is taught; teachers use the information to revise the lesson; and the process itself deepens the teachers' practice (Cerbin, B. & Kopp, B. 2011).

While the immediate fruits of lesson study are measurable and observable – finely tuned, highly effective lessons with increased student learning – the benefits to teachers and students is compounded through multiple iterations of this form of teacher development. Lesson study, above all, is a *process*. Through the lesson study process teachers develop a deep understanding of how a particular lesson should be taught for a particular group of students and why. Carried out over the course of a year or multiple years, then, developments build on themselves; instructional improvements and enhanced learning outcomes over time are solidified with synergistic effects (Lewis, 2002). It is not hard to see why 'lesson study' is so compelling, as it allows teachers to make sense of educational ideas within their own practice, to alter their perspectives about teaching and learning, to see their practice from their students' perspective, and to collaborate meaningfully with colleagues (Takahashi & Yoshida, 2004). In other words, while one group of teachers and students can benefit from a single implementation of lesson study, whole schools, communities of teachers, and even nations of students can improve from repeated implementation of this form of professional development (Perry, Lewis, Friedkin &Baker, 2009).

Implementing Lesson Study

A careful look at the essential features of lesson study and the necessary supporting conditions answers critics' concerns, providing a framework for successful implementation. Thoughtful teachers and critics have pointed out that importing lesson study to the US may not ensure improved instructional outcomes as it has in Japan. It is true that lesson study in itself is not a panacea capable of the quick-fix that

so many educators and policy-makers are looking for in the US. However, it is a useful tool with proven outcomes when done properly in the US. Before looking closely at successful US exercises in lesson study, it is must be stated that lesson study in the US, if it is to be successful, necessitates a complete understanding of "the underlying pathways that link the innovation [of lesson study] to instructional improvement" (Lewis, Perry, & Hurd, 2004). In other words, lesson study cannot be adopted in a ritualistic fashion; teachers cannot hope to go through the steps and expect desired outcomes without understanding *why* the particulars of lesson study create instructional improvements.

Lewis, Perry and Hurd identify seven key pathways to instructional improvement that are responsible for the success of lesson study: increased knowledge of subject matter; increased knowledge of instruction; increased ability to observe students; stronger collegial networks; stronger connection of daily practice to long-term goals; stronger motivation and sense of efficacy; and improved quality of available lesson plans (Lewis, Perry, & Hurd, 2004). Teachers engaging in lesson study begin by examining existing resources, textbooks and standards (Yoshida, 1999). Each participant is forced to confront his or her own understanding of subject matter and content knowledge as well as each other's levels of understanding. In addition, "much of what teachers learn during lesson study applies to areas beyond the particular lesson and subject matter," increasing knowledge of instruction (Lewis, Perry, & Hurd, 2004). During the research lesson teachers collect narrative data on students beforehand, observe and collect data on the lesson itself, and study students in depth. This type of focused observation leads to increased knowledge both of

students and of instructional methods. Moreover, the whole process of the research lesson brings teachers together, forging stronger collegial bonds. With a focus on long-term goals or an overarching question, lesson study addresses students' long-term development in addition to the content of a particular lesson (Lewis, Perry, & Hurd, 2004). With all these pistons firing – increased content and instruction knowledge, stronger collegial networks, focus on long-term goals – teachers experience success and gain a stronger motivation for their work as well as a search for increased efficacy. Put simply, " lesson study can strengthen the belief that improvement in teaching is possible" (Lewis, Perry, & Hurd, 2004). Finally, with one research lesson's conclusion, a tangible result is a highly effective, quality lesson that can be shared, published, re-taught and/or even further refined. These seven pathways lie at the heart of why lesson study is effective, and without an understanding of these forces at play, adopting lesson study in a rote fashion risks missing what makes it effable. In other words, lesson study must not be borrowed, but thoughtfully adapted.

US Initiatives

In 2004 Lewis, et al, wondered, "will lesson study become an important tool for instructional improvement or is it a short-lived fad?" Since 2004 lesson study has become a promising innovation, implemented effectively across the US: lesson study has been conducted in at least 32 states, 335 schools, 125 school districts, and with over 2,300 teachers participating (www.tc.columbia.edu/lessonstudy/timeline.html). My aim in the work presented here is not to enter the debate about whether lesson study can or cannot be widely implemented in the US. Rather, I argue that lesson study can and should be thoughtfully adapted for the Bank Street School for Children.

To this end, though, a closer examination of successful initiatives in the US gives insight into the power and potential of lesson study.

The first attempts to initiate 'lesson study' in US schools began in the late 1990s, when a handful of math education experts worked with teachers to form lesson study groups. One such group was in Valusia County, Florida, where a group of eight middle school math teachers began meeting regularly, developing research lessons and becoming familiar with the process. Each member of the group then brought 'lesson study' to their respective schools formally. Becky Pittard, a 4th and 5th grade math teacher, brought the practice to her school, Pine Trail Elementary School. Previously, teachers there did not really collaborate on improving instruction; they shared ideas and planned together, but did not have dedicated blocks of time or an effective process for improving teacher practices and student learning outcomes (Dubin, 2010).

For a period of two months, the 'lesson study' group at Pine Trail met, researching the best methods and resources for teaching the concept of percents and collaborating to develop a finely tuned, dynamic lesson. Every word and step of the lesson was meticulously crafted, and every possible student response considered. When it came time to teach the lesson, the Principal was brought in to observe and participate in the post-lesson discussion along with the 'lesson study' group members. Skeptical at first, Principal Barbara Paranzino became a full-believer: "I really thought it was so time-consuming… but teachers communicating with one another about a specific math concept? Teacher initiated professional development? – That's an administrators dream!" (Dubin, 2010, p. 7).

The group has been working successfully ever since, with principals from neighboring schools brought in to participate. Teachers have reinvigorated their practice and student learning outcomes, as measured by the teachers who participated in 'lesson study' and as measured by state and national tests, have improved. Pittard summed it up: "It's a huge commitment, but I'd rather I'd rather do this than attend a workshop and have someone tell me what I should be doing in my classroom" (Dubin, 2010, p. 8).

Another recent, successful initiative occurred at the Millburn Middle School in New Jersey. The research team there led by 7th Grade Math Teacher Kathy Cawley, initiated 'lesson study' within the broad, school-wide and district-wide goal of "examin[ing] ways to differentiate math instruction to meet the needs of all students (Cawley, 2009). The more specific aim was to "provide additional enrichment and challenge to 7th grade accelerated math students" (Cawley, 2009). The research lesson was developed from the 8th grade Connected Math curriculum with goals of recognizing exponential growth patterns, expressing the product of identical factors in both exponential and standard form, and writing equations for an exponential relationship. Following traditional 'lesson study' protocol, the team carefully considered the teacher's questions and anticipated student responses for the already-well-constructed Connected Math lesson. After the lesson was taught, evaluation was considered based on the following criteria: Did students see the exponential relationship? What strategies were the students using to write the equations and answer the questions? Were students challenged throughout the lesson? The team's evaluation was recorded and the lesson was refined. The process,

however, did not stop there, as this 'lesson study' lead to continued collaboration among the research team members, further iterations of the 'lesson study' process with other instructional lessons, and a deepening of teacher content knowledge, pedagogical understanding, and improved instructional outcomes for students (Cawley, 2009). In fact, the Millburn mathematics department continues to implement 'lesson study' to this day and credits the process with improving the instructional outcomes of this high-achieving public middle school.

What's illustrative from this example is that Millburn implemented 'lesson study' meaningfully, with teacher buy-in, and in a fashion that honored its purpose and intent as outlined by its Japanese architects. Moreover, while one measured success was the instruction of the lesson under study, the broader success comes from the collaboration and continued implementation by the mathematics department at Millburn as the primary form of professional development there.

Another successful implementation of 'lesson study', one closer to Bank Street both geographically and in pedagogy, occurred at Rye Country Day School, an independent co-educational day school in Rye, New York. A pair of Kindergarten teachers there hosted a two-day 'lesson study' in 2009. They sent out formal invitations to other Rye Country Day teachers, local area teachers, math education specialists, including at least one Bank Street College graduate professor. The teachers had previously identified a lesson to open up for further study and worked to refine it with the research group members. Then, the participants were invited to observe the lesson and asked to focus on a particular aspect of the lesson – the children's interaction with each other or evidence of learning and understanding.

After the classroom observation, the group debriefed using a self-modified version of traditional Japanese 'lesson study' protocols: After participants thanked the teachers for being invited to take part in the 'lesson study' each member shared the observations about the specific aspect of the lesson that he or she was tasked with recording. Rather than a mere critique of the teacher, the discussion centered on the evidence of learning and the efficacy of the lesson. The two kindergarten teachers used the feedback to re-write the lesson, which was finally shared with the larger group. The teachers credit the process with not only producing an extraordinary lesson but with deepening their content knowledge and practice and invigorating their teaching (Email correspondence with Rye Country Day School teachers, December 2012).

The initiatives in Valusia County, Millburn and Rye are but three examples of the success American teachers have had implementing 'lesson study'. Catherine Lewis, Sonal Chokshi and Clea Fernandez have thoroughly documented the myriad cases of 'lesson study' in US schools and made the case for its efficacy in improving instruction and learning outcomes. What remains to be argued, then, is the case for 'lesson study' at Bank Street School for Children.

Rationale for Lesson Study at Bank Street

"The mission of Bank Street College is to improve the education of children and their teachers by applying to the educational process all available knowledge about learning and growth, and by connecting teaching and learning meaningfully to the outside world" (http://bankstreet.edu/school-children/about-sfc/mission/). 'Lesson study' is an important part of that "available knowledge" that demands to be applied

both because of its efficacy and what I believe is the mirroring of Bank Street's philosophy. Indeed, lesson study is "Bank Street" by nature.

Teachers at the School for Children often plan collaboratively, and many attend professional development workshops, apply for grants or take course in the Graduate School to enrich their practice (Interviews with SFC faculty, 2012). In other words, teachers are committed to improving their craft and willing to dedicate time to do so. The School supports professional development as well by providing money and release time for workshops and courses.

A Framework for Lesson Study at Bank Street

Even with a deep understanding of the conduits of success at work within lesson study, a number of challenges arise putting it into practice. Chokshi and Fernandez of Columbia University identify three categories of challenges that US teachers face: one, challenges to launching lesson study; two, challenges to understanding lesson study, including misconceptions; and three, "challenges to deepening and sustaining lesson study work" (Chokshi and Fernandez, 2002). Understanding these challenges leads to more effective implementation, as my own experience bore out.

The potential challenges to launching lesson study include: that it is an "exotic" idea with no place in the US; that teachers do not have time for doing lesson study; that lesson study cannot be justified without proof of its efficacy; that American teachers do not have adequate content knowledge; that teachers will not welcome observation of themselves and their classrooms; and that lesson study cannot be done collaboratively because all teachers teach differently (Chokshi and

Fernandez, 2002). Thinking of these potential roadblocks with Bank Street in mind, it is easy to dispel a few immediately. For example, as a lab school, the School for Children has often been referred to as being a "fish bowl." Fellow educators and visitors regularly observe classes, and the idea that teachers would not be open to observation by their peers is not applicable. However, of these potential challenges, one did stand out: teachers' time. While lesson study is time-consuming, and finding time in teachers' schedules is difficult, it is "not impossible once teachers have made a commitment" (Chokshi and Fernandez, 2002). Currently, Bank Street teachers' free time is already filled with meetings; planning time is scarce during the school day, as even lunchtime is spent supervising children. Most teachers stay quite late, after students go home, and it is not uncommon for teachers to come to school on weekends to plan and set up their classes. However, with teacher buy-in and proper planning, the time-constraint barrier is removed. Ensuring buy-in is key. My hope is that the time taken to write, implement and reflect on 'lesson study' could be pivotal in influencing my colleagues about future work in this direction.

After teachers have made a commitment, keeping the lesson study time focused, on-point and running smoothly is critical. Invitations should be made personally. Resources for the research group must be prepared ahead of time. The pre-lesson conversation, research lesson, and post-lesson conversation must be scheduled at times when the greatest number of teachers have the highest chance of attending. If coverage were needed, that would be scheduled and coordinated.

Many of the potential challenges to understanding lesson study and misconceptions about it have been addressed in this paper, yet a few remain: the idea

that lesson study is about creating unique or never-before-seen lesson; that a school, group of teachers, class of students, etc. will not benefit from only a few lesson studies. First, lesson study does not necessitate re-inventing the wheel. It is about improving instructional outcomes and, as such, can mean adapting, borrowing or refining existing lessons. Second, by "engaging in the formal process of lesson study, teachers will carry an informal 'lesson study mentality' into their daily practice" (Chokshi and Fernandez, 2002). Framing lesson study as a tool with which Bank Street teachers are already somewhat familiar, if not formally or in name will not only pique interest but also convey that it is not about reinventing the wheel. In other words, for School for Children teachers, who have already experienced focused classroom observations and may hunger for more, 'lesson study' could be couched as something not unlike experiences they've already had. Teachers are, in fact, already masters at their craft, and they need not discard what they know in order to engage in lesson study.

Of the challenges to sustaining lesson study work, two stand out: the misconception that lesson study naturally leads to rich conversations about practice, and the idea that lesson study is easy to learn but difficult to master. Many teachers may welcome lesson study in theory, may even welcome the idea in practice enough to engage in it, yet when "sharing their feedback about the observed lesson or examined lesson plan, teachers and other observers maintain politeness at all costs and offer superficial and tentative feedback rather than constructive criticism" (Chokshi and Fernandez, 2002). In order for constructive, honest feedback to be shared, a non-threatening, non-judgmental atmosphere must be created. To this end,

the process and key understandings of lesson study must be explained to all participants. In a "research lesson" feedback must remain focused on the lesson itself – the choices made by the teacher(s), the wording used, the structure, etc. – as well as on the students and their responses and work. In other words, participants must understand that the teacher teaching the lesson is not being judged. At the same time, however, superficial, overly praising comments are not useful. The aim is to deepen instructional understanding and understanding of students' levels of learning. Comments must be made with this in mind and knowing that shying away from critical feedback risks making the endeavor one of going through motions.

Lesson Study at Bank Street SFC: An Experience

I first heard the term 'lesson study' in conference group, a weekly meeting of peer professionals enrolled in the Master's of Science in Education program at Bank Street College, from my advisor Hal Melnick. I was intrigued by the idea, but did not give it much thought as I focused on my weekly course work, my duties as an Assistant Teacher, and finding a job for the following school year. A year later, having secured a Head Teacher position teaching math and science at Bank Street School for Children, I was impressed with teachers' dedication and commitment to improving teaching practices and learning outcomes for children. However, I kept hearing teachers exclaim, "I wish I could visit more classrooms [to see what others are doing]," and "I wish there was more time for collaboration," and even "I don't find many traditional teacher workshops very helpful anymore in my practice" (Informal conversations with colleagues at Bank Street School for Children, NYC, September 2010-June 2011). Personally, I was craving collaboration with teachers

with whom I don't usually work and with the Graduate School. These experiences, and the fact that the Graduate School and School for Children are housed in the same building, make for a logical and seemingly obvious opportunity, and it was in this atmosphere that my first foray into lesson study began.

In April 2012, in consultation with Dawna Lopez Serrato, my Math-Science teaching partner and colleague, I chose a lesson to open up for study. The lesson was from Connected Math and focused on multiplication of fractions (See Appendix A for the complete lesson plan). The lesson fell in the last third of the school year (the third trimester). There were 21 students, ages 10-11, in the class. Five students had Individual Education Programs (IEPs) on record with the NY Department of Education. In addition, there were at least two exceptionally gifted math students in the class. (For more information on the students in the class, see Appendix B).

The overarching theme our math/science department had been focusing on that year was "differentiation" – how to meet the needs of the range of learners in our classrooms, especially given that our math classes are heterogeneous, not grouped by ability. So the broad goal the group identified was this goal of differentiation. The 'big idea' of the lesson was performing mathematical operations with fractions. The specific learning objective of the lesson was for students to understand how to find a fraction of a fraction (multiplication of fractions) using the square-area model (also called the array model). In this lesson, finding the fractional amount of "the whole" meant that "the whole" itself was a fraction. Therefore, the final amount is a fraction of a fraction of a whole. Key lessons that preceded this lesson included: interpreting fractions as part-whole relationships (finding fractions of a whole); interpreting

fractions as operators (i.e., 3/4 of 20); combining and comparing fractions; finding equivalent fractions; factorization of numerators and denominators. Key vocabulary of the lesson included: fraction, numerator, denominator, equivalent, and multiplication. Students needed to bring past knowledge of fractional amounts, finding a fraction of a group and using fractions as operators. Students also needed to be able to work in a small group effectively.

As part of the pre-lesson planning the preceding information was documented. Then, after invitations were sent to participants, this information, along with a plan and explanation of 'lesson study' was shared with the research group before meeting for the first time (for the documents sent to participants see Appendix B). Members of the research group were all from Bank Street and included Christabel Pinto, 12/13s Math-Science Teacher, Alicia Kachadourian, 9/10s Math-Science Teacher, Traci Pearl, 11/12s Math-Science Teacher, Jose Guzman, Math/Science Coordinator, Elizabeth O'Mara, Learning specialist, and Hal Melnick, Graduate School Instructor and Fieldwork Supervisor. The group met for one hour on the morning of May 3, 2012. Dawna and I thanked the group for participating; we went through the background information on the students in the class and took questions; we went through the lesson itself carefully and took questions. Finally, we instructed group members to focus on specific students and aspects of the lesson: the student reactions to the opening of the lesson, student interactions during the group work part of the lesson, and evidence of understanding, both written and oral. During this meeting at least one suggestion to modify the lesson came up. However, since the lesson was to be taught later that morning, Dawna and I had decided not to accept feedback on the

lesson at this point, only taking clarifying questions about the lesson and the process. If we had been following the traditional 'lesson study' protocol for closely, this pre-lesson meeting and conversation would have taken place some weeks ahead of the scheduled teaching of the lesson, but scheduling would not permit this for this first trial of 'lesson study' at Bank Street.

Only 45 minutes after the pre-lesson conversation, Dawna and I taught the lesson as the group observed. We stuck to the plan outlined ahead of time and the observers focused on their observational assignments.

Later that afternoon, the group met again for one hour in a post-lesson conversation. In this meeting participants thanked the teachers of the lesson, Dawna and Ryan. One-by-one each member of the research group shared his or her observations on lesson, focusing on the guiding questions and students previously identified. The following comments are transcribed from this meeting:

Hal Melnick: I was struck with the belaboring of the April, Ava, Madison group. I was surprised that students did not ask questions of each other's comments and contributions; they did not challenge or extend each other, ask clarifying questions or extend the debate. They each merely added their own ideas. It is difficult to answer the question of whether 'deep' understanding took place for every child. The group I observed most closely, the April, Ava, Madison group, needed an adult there in order to work through the problem. Evidence from their work and their conversation indicates there are still misconceptions, namely, what counted as 'the whole.' April

literally closed her eyes during the opening question part of the lesson. It was a difficult question/problem, but that doesn't mean it was inappropriate.

Elizabeth O'Mara: I wonder how it could have been structured differently to avoid the fact that the 'smart groups' got it and the 'weaker groups' didn't. Could there be different questions for different groups? What would have happened if the groupings were less homogenous? April was actually more engaged than I expected, given her learning profile and my experience working with her. Ava would not listen to April's ideas and needed to be 'in charge.'

Alicia Kachadourian: There was not much debate or questioning of the question at the opening of the lesson. Could a 'turn-and-talk' or having students rewrite the question in their own words have helped? Observations of the April, Ava, Madison group showed they did not understand the question; they needed an adult to re-phrase and explain the question multiple times.

Christabel Pinto: Lily, the student I focused on, said "Ryan bought 2/9 of the entire pan, but 2/6 of what was left of the brownies." This showed deep understanding. She understood that the fraction that remained was different of the fraction of the whole pan. Dawna had to help the April, Ava, Madison group extensively to interpret the question; they had to be walked through it. This was necessary.

Jose Guzman: the opening question was clear and well worded. There was a lack of response, and I'm not sure if that was because they all understood the question or they aren't used to probing further and asking questions about the problem. Lily struggled but kept at it and by the end showed understanding in her work and in her dialog with her partners. April smiled at the end when she heard other groups share out and realized she had the proper answer. She needed the one-on-one support but she was proud of herself at the end.

After this go-around of sharing, Dawna and I thanked the team for their time. We recorded this feedback and deliberated about what we would do differently if we were to teach this same lesson to the same group of students. We determined that we would keep the groups homogenous but have a different question for each group to investigate. Each student would have to put the question into his or her own words before beginning. In addition, we determined that we would preview the lesson ahead of time with April, Ava and Madison specifically. Lastly, the sharing out would happen the following day, and each group would get to share its own scenario and solution with the class. (For the complete revised lesson, please see Appendix C). After the whole experience I received a personal 'thank you' from each and every participant and there was momentum and desire to do this again. Other teachers wanted to do it for their own lessons; they wanted to be both the participant again and teacher bringing up her own lesson for study.

Conclusions

Put simply, lesson study has a place at Bank Street. We did not import the procedure exactly as it is followed in Japan, but we kept true to the ideal of understanding "the underlying pathways that link the innovation [of lesson study] to instructional improvement" (Lewis, Perry, & Hurd, 2004). All seven of the pathways to instructional improvement that lesson study offers, outlined by Lewis, Perry and Hurd, surfaced during our lesson study process. My knowledge of subject matter increased as I deepened my own understanding of multiplication of fractions, namely by increasing my awareness of possible misunderstandings and student misconceptions. Our lesson study increased all participants' ability to observe students. As evidenced by the reaction notes from participants, the process built stronger collegial relationships; we all shared in a common activity and teachers felt more connected to each other and our work immediately afterwards. Moreover, our lesson study solidified for those involved our commitment to our daily practice and the Math-Science department's long-term goals of differentiated instruction and meeting the needs of all of our learners. In addition, our lesson study process improved my own motivation and sense of efficacy as I was imbued with energy about my practice that had not been present since I was a first-year teacher. Finally, it also ultimately resulted in a stronger lesson, thus "improving the quality of available lesson plans" (Lewis, Perry, & Hurd, 2004).

Running lesson study at Bank Street, however, was fraught with many of the challenges specified by other lesson study practitioners and previously anticipated. While challenges to launching lesson study were present (teachers' time is scarce and

already filled with a plethora of meetings and other school-wide initiatives that require teachers' commitment) we were able to find the time for the meaningful work of lesson study to take place. More significant were the "challenges to deepening and sustaining lesson study work" (Chokshi and Fernandez, 2002). This lesson study group formed in April of 2012, and at the time of this paper, April 2013, there has not been another lesson study group at Bank Street. In order for lesson study to continue to run at Bank Street there must be a commitment from the teachers as well as the administration. A small group of teachers, for our part, can continue to run lesson study, enriching our practice, improving instruction and building the momentum for embracing it more fully and more broadly. In other words, I believe more iterations of lesson study will prove meaningful for those involved, as it was for this group, and generate further interest. At the same time, however, the School needs to embrace the idea of lesson study as a serious form of professional development. That is, there must be a commitment on the part of school leaders to recognize lesson study's potential and efficacy, and to commit time and resources towards lesson study in the way the School does for common professional development workshops, school visitations and curriculum work. Bank Street is perfect for lesson study and lesson study is perfect for Bank Street. In the words of one participant of our lesson study, "Why don't we do this more often?" (Christabel Pinto, conversation May 3, 2012).

Appendix A

Lesson Plan

Learning Objectives

- Students will use an array model to represent the product of two fractions
- Understand that finding a fraction of a fraction means multiplication of the two fractions

Intro

Teacher asks, "What is 1/2 of 2/3?"
Solicit student responses.

Teacher displays on SmartBoard and reads aloud the following scenario:

"A pan of brownies costs $18. You can buy any fractional part of a pan of brownies and pay that fraction of $18. For example, ½ of a pan costs ½ of $18. Ryan asks to buy 1/3 of a pan that is ⅔ full. What fraction of the whole pan does Ryan buy? How much does Ryan pay?"

Ask students to re-phrase the problem in their own words.
Solicit responses orally.

Activity

Distribute copies of the scenario with a square drawn and space for written explanation (see following page).

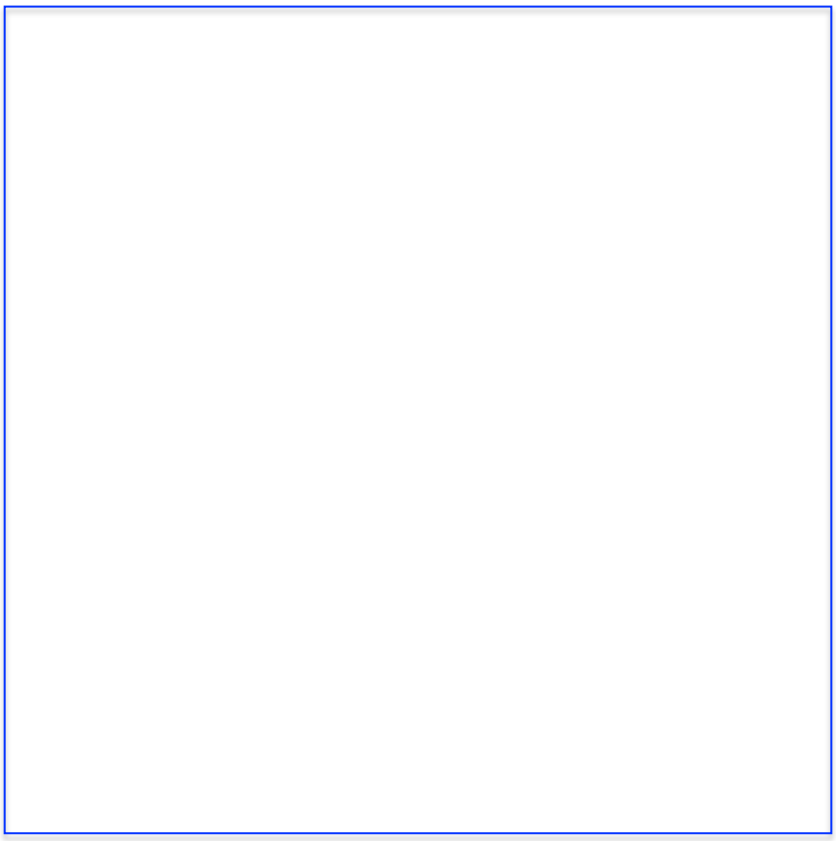
Students work in groups of 2-3 to solve the problem.
Students are grouped by ability/readiness (as determined from formal and informal normative pre-assessment) for this problem.

Share-out

A few students share their array-model representation and explain their solution and understanding.

BROWNIE PROBLEM

A pan of brownies costs $18. You can buy any fractional part of a pan of brownies and pay that fraction of $18. For example, ½ of a pan costs ½ of $18. Ryan asks to buy 1/3 of a pan that is ⅔ full. What fraction of the whole pan does Ryan buy? How much does Ryan pay?



Appendix B

Pre-lesson Materials Sent to Participants

I. General Info

A. Background Information

1. This lesson falls in the last third of the year (3rd trimester)
2. Students are ages 10-11
3. There are 21 students in the class
4. 5 students in the class have IEPs and/or receive learning support services
   - i. i. Alex – attention, grapho-motor skills, speech and language (expressive and receptive), processing, executive functioning, significant social/emotional
   - ii. April – reading comprehension, working memory, long-term memory, stamina
   - iii. Caillin – grapho-motor (OT), visual/spatial
   - iv. CJ – reading comprehension, fluency, attention, stamina
   - v. Lily J – speech and language (verbal expression)
5. Dawna, 10/11s Math-Science, is the other teacher in the class. Her role in this lesson is co-teacher

B. Range of Learners

For this lesson, please focus on the following three students, each with distinctly different learning profiles

1. April – see above. (*attach old samples of work*)
2. Paul – very bright, strong abstract thought capabilities, strong aural and visual learner, engages with learning intensely in mathematics, picks up concepts quickly, loves to be challenged, learns well both independently and cooperatively (*attach old samples of work*)
3. Lily – *fill in info.* (*attach old samples of work*)

II. Today's Learning Experience

A. Math Goals for Students

- Big Idea: Performing mathematical operations with fractions
- Specific Learning Objective of this Lesson: Students will understand how to find a fraction of a fraction (multiplication of fractions) using the square-area model
-

B. Teacher's Perspective on Content of Lesson

- The important math content of this this lesson is the concept of finding a fraction of a fraction. The big idea here is using fractions as operators with other fractions. In this case finding the fractional

amount of "the whole" means the whole is a fraction, so the final amount is a fraction of a fraction of a whole.

- This lesson fits into the Rational Number Unit of the 10/11s Math Curriculum. Specifically, it fits within the context of performing mathematical operations with fractions; understanding and interpreting fractions (as part-whole relationships, ratios, proportions, and scale factors) and partitioning and repartitioning fractions. (Note: See attached "10s/11s Math Overview" for content goals, process goals, and scope and sequence of 10/11s Math Curriculum.)
- Key lessons that come before this include: interpreting fractions as part-whole relationships (finding fractions of a whole); interpreting fractions as operators (i.e., 3/4 of 20); combining and comparing fractions; finding equivalent fractions; factorization of numerators and denominators. Students have had all these lessons, then we switched to our Geometry Unit, then we came back to the Rational Number Unit, starting with a review of the lessons mentioned above.
- Key lessons to follow this lesson include: using thermometers and number lines as partitioning models; modeling multiplication of mixed numbers; exploring equivalency as a strategy for multiplication of fractions; developing and mastering an algorithm for multiplication of fractions.
- *Review of Old Samples of Focal Students' Work*
- Vocabulary used in the less: Fraction, Numerator, Denominator, Equivalent, Multiplication
- *What experience, knowledge, and skill do students need to bring to participate and meet the goals of this lesson?*

Appendix C

Revised Lesson Plan

Learning Objectives

- Students will use an array model to represent the product of two fractions
- Understand that finding a fraction of a fraction means multiplication of the two fractions

Intro

Display on SmartBoard a square array split into thirds vertically, not labeled.
Teacher asks, "What is 1/2 of 2/3?"
Have students "turn and talk" to a tablemate.
Solicit student responses.
Shade 2/3 on the model and then shade 1/3 a second time, darker.

Tell students that each of them will be given a scenario in which there is a pan of brownies that is some fraction full and that Ryan is going to buy a fraction of what is left.

Group students by ability/readiness (as determined from formal and informal normative pre-assessment) for this problem.

Distribute three different versions of the same "brownie problem" (see the following pages for the three different handouts and scenarios), tiered to meet the abilities and readiness of each group.

Activity

Students work in their groups of 2-3 to solve the problem.

Share-out

Have three different groups of students, one from each scenario, share their array-model representation and explain their solution and understanding. Use document camera to display their work while they explain orally.

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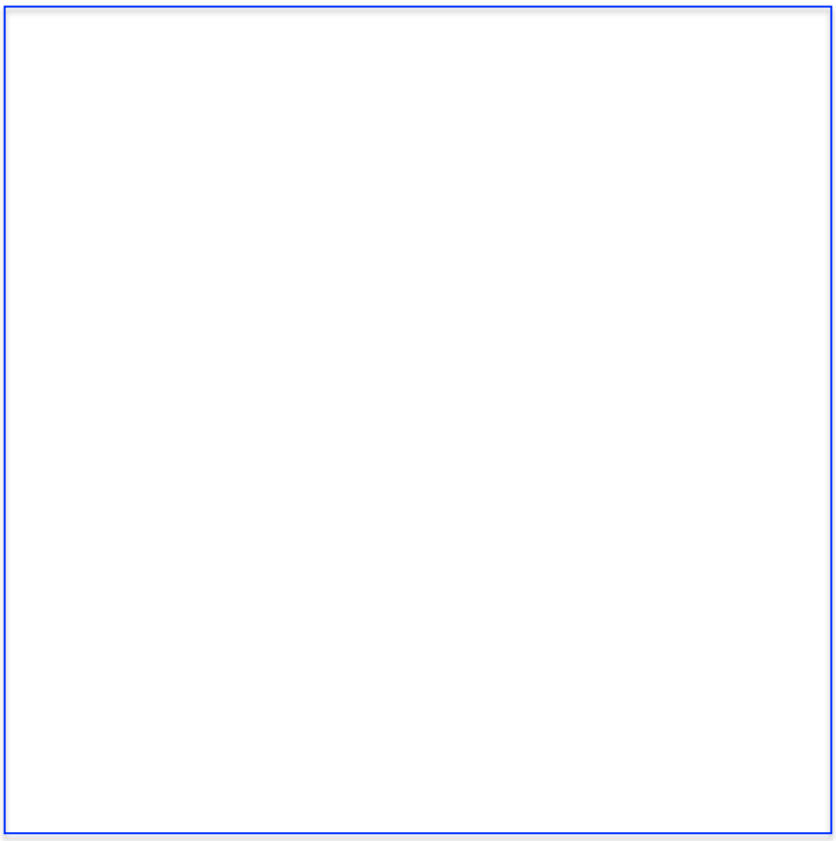
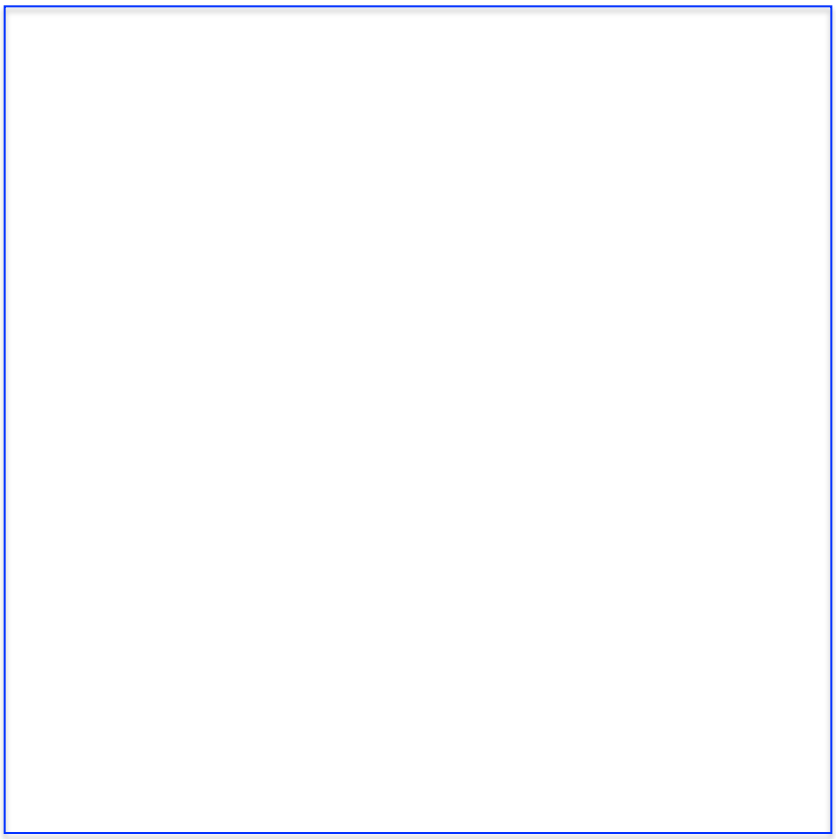


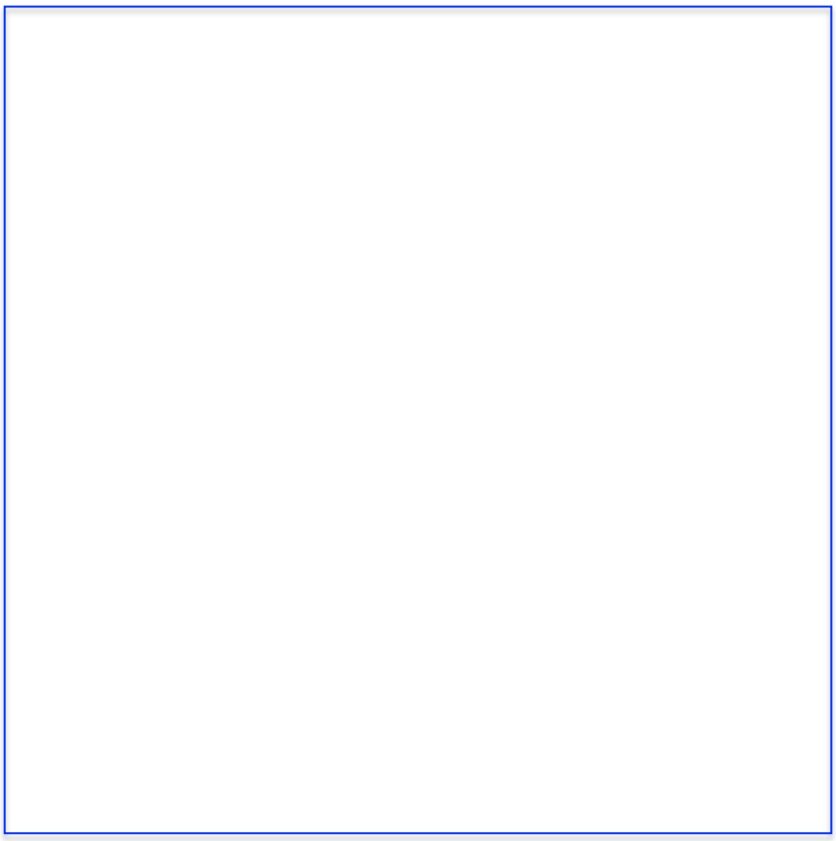
BROWNIE PROBLEM

A pan of brownies costs $12. You can buy any fractional part of a pan of brownies and pay that fraction of $12. For example, ½ of a pan costs ½ of $12. Ryan asks to buy ½ of a pan that is ½ full. What fraction of the whole pan does Ryan buy? How much does Ryan pay?



BROWNIE PROBLEM

A pan of brownies costs $18. You can buy any fractional part of a pan of brownies and pay that fraction of $18. For example, ½ of a pan costs ½ of $18. Ryan asks to buy 1/4 of a pan that is ⅔ full. What fraction of the whole pan does Ryan buy? How much does Ryan pay?



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