How Does Lesson Study Transform Teaching and Teachers' Learning?

Catherine C. Lewis, Mills College, U.S.A.

World Association of Lesson Study Exeter, England September 4, 2016





This material is based upon work supported by the National Science Foundation under Grant No. 0207259. Any opinions, findings, and conclusions or recommendations are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.



This material is based upon research supported by the Department of Education Institute for Education Sciences, Grant Nos. R308A960003, R305A110491 & R305A110500. Any opinions, findings, and conclusions or recommendations are those of the authors and do not necessarily reflect the views of the grantors. BILL& MELINDA GATES foundation

This material is based upon research supported through funding by the Bill & Melinda Gates Foundation. The views, findings, conclusions, and recommendations expressed herein are those of the authors and do not necessarily express the viewpoint of the foundation.



Partner Chat: An Experience in Which Lesson Study Transformed Teaching or Teacher Learning? Where in the Cycle Did It Occur?

Study

Curriculum Content, Teaching Materials, Long-term Goals

Reflect

On Data, Analyze Student Work, Consider Implications

Plan

Research Lesson, Unit

Do

Research Lesson, Collect Data Observe Students and Instruction



There is Evidence That Lesson Study Transforms Teaching and Teachers' Learning...

Two randomized, controlled trials



Lesson Study Shows Impact On:



Let's Briefly Look at the Studies

- Mathematical resources provided for lesson study cycle
 - Tasks, curriculum materials and video of classroom lessons–many from Japan
- Mailed the resources (or provided them online) to groups across the United States
- Groups of 4-9 educators self-managed lesson study cycles (40% of participants were new to lesson study)



Let's Briefly Look at the Studies...

- One study focused on fractions (Lewis & Perry, in press; Journal of Research for Mathematics Education)
- One study focused on "Teaching Through Problem-Solving" (still under review)
- The fractions study was one of only 2 studies of mathematics professional learning-of 643 studies reviewed-that met WWC scientific criteria and showed impact on student mathematics learning (Gersten et al., 2014)



"Teaching Through Problem-Solving" (問題解決学習)

 An approach to mathematics teaching that originated in Japan

When we watched a Japanese lesson, ... we noticed that the teacher presents a problem to the students without first demonstrating how to solve the problem. We realized that U.S. teachers almost never do this...the [U.S.] teacher almost always demonstrates a procedure for solving problems before assigning them to students.

(Stigler & Hiebert, 1999, p.77).



Teaching Through Problem Solving



From: http://www.LSAlliance.org

See also McDougal & Takahashi & 2014

Elements of Teaching Through Problem-Solving

- The task embodies the mathematics to be learned
- Teachers anticipate student solution strategies, strategically choose and order student presentations
- Discussion of student work develops new mathematical ideas
- Board carefully organized to capture flow of lesson and provide model for student note-taking
- Student reflective mathematics journals provide site for students to solve, compare solutions, and reflect on learning
- Teachers begin class by sharing journals that highlight mathematical ideas and practices (e.g., persistence)



Transformation of Teaching





Persistence

Student Survey, 2 items:

- I keep trying until I solve a math problem.
- On math problems, I give up easily. (reversed)

Behavioral Measure of Persistence:

- Number of different solution strategies students in response to items requesting show of work
- Presence of verbal or diagrammatic explanations where requested



Pre (left) and Post (right) Responses







Teachers' Content Knowledge (Fractions)

- 33-item teacher assessment
- 21 items from University of Michigan Learning Mathematics for Teaching Project
- 12 items from 2 other published assessments (Univ. of Louisville and New Zealand Maths) and 6 research studies

Example:

A group of students are investigating the books they have in their homes. Steve notices that 1/2 of the books in his house are fiction books, while Andrew finds that 1/5 of the books his family owns are fiction. Steve states that his family has more fiction books than Andrew's.

- a) Is Steve necessarily correct?
- b) Why or why not?



Lesson Study With Mathematical Resource Kit: Impact on Teachers' Fractions Knowledge



Teachers' Fractions Knowledge (33 Items, 21 From LMT; 2-level HLM, effect size .18, p<.05)

Expectations for Student Achievement

- By trying a different teaching method, I can significantly affect a student's achievement.
- No matter how hard I try, some students will not be able to learn aspects of mathematics (reverse coded).
- My expectations about how much students should learn are not as high as they used to be (reverse coded).
- Students who work hard and do well deserve more of my time than those who do not (reverse coded).
- The attitudes and habits students bring to my classes greatly reduce their chances for academic success (reverse coded).
- There is really very little I can do to ensure that most of my students achieve at a high level (reverse coded).
- Most of the students I teach are not capable of learning material I should be teaching them (reverse coded).



(7 items; Alpha=.63 on pretest; .64 on posttest; from McLaughlin & Talbert, 2001 & CRC 1991)

Research Relevance for Practice

- Educational research often provides useful insights for teaching.
- In general, curriculum materials from other countries are not useful.
- Most research is not relevant to my needs as a teacher.
- I find it interesting to read about a variety of educational programs and ideas

 Lesson Study 授業研究 (4 items; Project-developed; .64 at pretest and .66 at posttest)

Perceived Effectiveness of Collegial Learning in Mathematics

- I have learned a lot about student thinking by working with colleagues
- Working on mathematics tasks with colleagues is often unpleasant (rev)
- I have good opportunities to learn about the mathematics taught at different grade levels
- I have learned a great deal about mathematics teaching from colleagues
- I find it useful to solve mathematics problems with colleagues



(5 items; alpha: .62 pretest, .63 posttest)

Impact of Lesson Study on Teachers' Beliefs (HLM Analyses)

Significant Positive Impact (p<.05) on:

- Perceived Effectiveness of Collegial Learning
- Expectations for Student Achievement
- Research Relevance for Practice



Professional Learning Quality

- Built on my existing knowledge of teaching and learning
- Helped me consider how to apply what I learned...
- Gave me ideas I would like to share with colleagues
- Was intellectually engaging and important
- Helped me see how content ideas are connected...
- Encouraged my active participation
- Valued my opinion, experience, and contributions
- Supported my own professional inquiry and investigation...
- Encouraged me to share ideas and take intellectual risks
- Included intellectual rigor, constructive criticism...
- Encouraged me to become more of an educational leader in my school/ district

(11 items; Adapted from Horizon Research, 2000; alpha .95)

Quality of Professional Learning



So why and how do transformations of teaching and teachers learning occur?



What Learning Occurs at Each Part of the Cycle?





Lesson Study in the History Classroom – Reading Historical Accounts and Source Documents to Enhance Content Knowledge



A BRIEF HISTORY WITH DOCUMENTS

Theda Perdue

Courtesy of Stan Pesick Stanley.pesick@gmail.com











"[A] marvel of storytelling... a vital, important book — a book that matters not only to the reader interested in Vietnam, but to anyone interested in the craft of writing as well." — NEW YORK TIMES

Lesson Study in the History Classroom : Enhancing Disciplinary and Pedagogical Knowledge through Shared Readings









Lesson Study in the History Classroom - Working with Historians to Frame Historical Content and Issues for Investigation



Lesson Study in the Humanities Classroom – Working with Poems Across Disciplines

"Trethewey is clearly a poet to savor." — Maxine Kumin "Remarkable." — Robert Pinsky, Washington Post



NATASHA TRETHEWEY Poet Laureate Shigherläwsteak Strates 2012-2013 From "Native Guard" by Natasha Tretheway

March 1863

I listen, put down in ink what I know they labor to say between silences too big for words: worry for beloveds -My Dearest, how are you getting along – what has become of their small plots of land – did you harvest enough food to put by? They long for the comfort of former lives -I see you as you were, waving goodbye. Some send photographs — a likeness in case the body can't return. Others dictate harsh facts of this war: The hot air carries the stench of limbs, rotten in the bone pit. Flies swarm — a black cloud. We hunger, grow weak.

When men die, we eat their share of hardtack.

"STUDY" Phase: Study Video from Another Curriculum

"Looking at the example text and teacher's information provided, I never would have imagined the lesson going in this direction or taking this long. I would probably have given students the information quite quickly and not posed the questions in this format. I need to be reminded of the importance of posing problems to solve and discover."



"STUDY" Phase: Develop Research Theme

- What are the qualities you want students to have when they graduate your school?
- What are their qualities now?
- What is a gap between the ideal and actual that motivates you as an educator?



Research Theme at "Ridgeway" High School Mathematics Department

"Building students' organization and study skills, effort and persistence, and active self-advocacy"

- High school math department differed sharply in age and educational philosophy
- Experienced and new teachers discovered each other's knowledge and concerns
- Research theme represented them all
- Concrete strategies for self-advocacy



"STUDY" Phase: Study Own Curriculum and Standards

U.S. elementary teachers looked at addition-subtraction standards for kindergarten, grade 1, grade 2, and noticed subtle differences over grades

Kindergarten: "Add and subtract within 10, e.g., by using objects or drawings to represent the problem"

Grade 1: "Add and subtract within 20.... Use strategies such as counting on; making ten...; decomposing....; using the relationship between addition and subtraction...."

Grade 2: "Fluently add and subtract within 20 using mental strategies."

Teacher: "I never realized you need to compare across the grades"



"STUDY" Phase: Study Other Curriculum



"In the past, I have worked hard to make fractions very hands on and visual, but not once did I consider using a linear model."

What Learning Occurs At Each Part of the Cycle?



 Lesson Study 授業研究

"PLAN" Phase-Teachers Try Task (A Harder Version of Mystery Strip: 2/7)





Teachers' Conversation About Mystery Strip

- T1: [iterates full strip, then half strip along meter strip] "<u>seven</u> <u>halves of a whole</u>"
- T2: [iterates full strip] "one and a third I'm rounding"
 T4: "But you're left with some parts."
 T1: "But this is one meter."
- T3: [iterates full strip] "<u>3 and ½ of these to get that,</u> <u>so...</u>"
- *T4: "<u>2/7 over 7/7 or 14/49ths.</u> This* is 7 over 7, right? And *this* is two of the 7/7ths. So, 2 over 7 times 7 over 7, which is 14 over 49."
- T3: "...which is 2/7ths"
- T1: "I don't think it's 2/7ths." [Finds ½ meter and compares mystery strip to this ½ meter benchmark.]

Teacher Reflection on Lesson Study's Impact on Practice– 8th grade U.S. History



Excerpt from "History at the Center I - Introducing Lesson Study in History Classrooms," Oakland Unified School District Teaching American History Project, 2003



"DO" Phase: Task Reveals Student Capacity

We were interested in how our students would react to such a lesson. We felt that the population of students [in the video] was quite different than ours. We weren't sure if our students would be as flexible in their thinking; however, we were very pleasantly surprised!



"DO" Phase: Task Reveals Student Capacity

One of the things that stood out the most to me during this process was how well students did on meeting the objective without getting any kind of direct instruction. It makes me think that as a teacher I need to bridge what they already know and are able to figure out on their own to what I am teaching. [23:628]



"DO" Phase: See Impact of Lesson Elements History Question: Was Qin Shi Huang an Effective Ruler? Lesson Study Focus: Elaboration, Citing Evidence, and Writing

Citing Evidence in Text:

he was mean to his workers, he buried them alive, and yeah, he did it, he wouldn't let them stop working hard, they couldn't stop working Could you show me where in the text is says that he buried his workers alive?





"DO" Phase of History-Language Arts LS: Discover Problem of Graphic Organizer

"Messiness" is an important learning element, began to look "instead for ways to help students make sense of and take ownership over the process."





What Learning Occurs At Each Part of the Cycle?





"REFLECT" Phase: New Views from Commentator or Colleagues

"The information my lesson study colleagues gathered while observing the lesson was very eye-opening. I would never have realized how many misconceptions my students had about fractions.... Having additional eyes and ears in the classroom during a lesson is extremely valuable to me as a teacher. ...The collaboration that occurs before, during, and after a lesson is extremely valuable to me."



"REFLECT" Phase: New Dispositions

The lesson study process has become embedded in me as an individual even without others there...I'm always thinking what are my goals, what do I expect, what did they understand... how could I make that better? What will I change if I do it again?

Middle School Mathematics Teacher, Florida



"REFLECT" Phase: Changed Relations With Colleagues

It's changed how we approach our daily lives. We share everything. If I have a great lesson I'll tell people about it. We're more confident sharing – previously I wouldn't have admitted that I did a lesson that was a flop. There used to be a barrier of feeling like you're stealing if you share lessons. That barrier is gone now.

Middle School Mathematics Teacher, Florida



But Lesson Study Does Not *Necessarily* Transform Teaching and Teachers' Learning What Conditions Are Essential?

- Access to knowledge
- Collaborative interactions
- Joint enactment in practice
- Motivational conditions



Condition 1: Access to Knowledge

- Best available research
- "Research" does not just mean traditional research or even things written on paper, but also curriculum materials, video examples, etc.



What Kinds of Knowledge Are Useful to Lesson Study Teams? Please talk...



What Kinds of Knowledge Are Useful: Curriculum Materials





Tokyo Shoseki; New English-language version available at http:// www.koyopublishing.com/

Video of Classroom Lessons





Knowledge Resources May Not Be Traditional Research...

My favorite part is always watching [the instructor on the video] in action...He is so good at using wait time, posing questions that really make students think, using language that doesn't hint to the right or wrong answer and using the students' own work/ideas to motivate them....Looking at the example text and teacher's information provided, I never would have imagined the lesson going in this direction or taking this long. I would probably have given students the information quite quickly and not posed the questions in this format. I need to be reminded of the importance of posing problems to solve and discover.



Access to Knowledge: Does Your Country Have a Textbook System That Incorporates Teachers' Learning from Lesson Study?

Japanese textbooks do.

For example, they have shifted to support Teaching Through Problem-Solving.

From 1958 to 2008, "open problems" (no specific numeric answer) shifted from 0% to 40% in textbook fractions units. (Watanabe 2014)



Condition 2: Collaborative Interactions



Contrast of Traditional Professional Development and Lesson Study

TRADITIONAL PD

- Begins with answer
- **Driven by expert**
- Communication trainer -> • teachers
- **Relationships hierarchical**
- Research informs practice

LESSON STUDY

- Begins with question
- **Driven by participants** •
- **Communication among** • teachers
- **Relationship reciprocal** •
- Practice is research



By Lynn Liptak, Paterson School #2, New Jersey, www.lessonresearch.net

Is the Interaction Collaborative?

- Is one person making all the decisions?
- Is it "my" lesson or "our" lesson?
- Are teachers seeking answers to a research question they care about, or just following steps prescribed for them?
- Do teachers actively pull in knowledge and expertise, or is it forced onto them?



Collaborative Structures Sustain Motivation

It was difficult to work on these ideas without a team or even a partner.... I understand that in its initial iteration, this program was true to 'lesson study' in that it was designed for teams of teachers. I still think that is the best format, so that teachers are motivating each other and are less likely to get discouraged.



Condition 3: Joint Enactment in Live Practice

- Lesson as deadline (Academics might talk forever....)
- Lesson as negotiation
- Lesson as translation
- Lesson as formative feedback on your ideas
- Lesson study is not just about one lesson but bigger vision
 - Unit focus
 - School-wide research theme
 - School-wide structures to research, such as journals or discussion



Condition 4: Motivational Conditions

Improvement of teaching is hard, ongoing work, that is never complete

So motivation to sustain that work is essential



What kinds of organizations motivate?

Human beings are intrinsically motivated in organizations that meet 3 basic human needs:

- Agency (autonomy)
- Belonging
- Competence
- The New "ABC's"

Such organizations elicit our hard work and desire to work for the common good

Deci & Ryan, 1985. *Intrinsic motivation and self-determination in human behavior*.



Lesson Study: Research or Professional Learning?



An Argument





Certs is a breath mint. NO! Certs is a candy mint. NO! You're both right!

- Lesson study is professional learning. NO! Lesson study is research. NO!
- It is both



Lesson Study is Research Because

- It begins with a question, not an answer
- Builds on prior knowledge (from written sources, and practice as well)
- Knowledge is tested and contested, warrants from looking at student responses are needed; authority is not enough



Lesson Study is Professional Learning Because

- Improvement of teaching and learning is the primary goal– not knowledge for knowledge's sake
- Many important products of lesson study are not traditional research products and are not even knowledge, e.g.,
 - Changed relationships among teachers
 - Changed beliefs about learning
 - Changed instruction
 - Shared understanding at a school about the long-term purpose of education
 - New habits of considering daily instruction in light of long-term goals



Why Is It Important to See Lesson Study as Research *and* Professional Learning?

 Because we need BOTH a better knowledge base about effective teaching AND educators whose beliefs, knowledge and professional community lead them to use that knowledge



Further Information & References

- <u>clewis@mills.edu</u>
- www.lessonresearch.net/ttp
- McDougal, T., & Takahashi, A. (2014). Teaching Mathematics Through Problem Solving. *Independent Teacher, Fall*.
- Gersten, R., Taylor, M. J., Keys, T. D., Rolfhus, E., & Newman-Gonchar, R. (2014). Summary of research on the effectiveness of math professional development approaches. (REL 2014-010). Retrieved http://ies.ed.gov/ncee/edlabs
- Watanabe, T. (2014). Transformation of Japanese elementary mathematics textbooks: 1958 – 2012. In Y. Li, E. Silver, & S. Li (Eds.), *Transforming mathematics instruction: Multiple approaches and practices.* (pp. 199 – 216.). Heidelberg: Springer.

