Strengthening Lessons and Schools Through Lesson Study

Catherine Lewis
Mills College, Oakland, CA
clewis@mills.edu

Utrecht, May 9, 2017

www.lessonresearch.net
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.

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.
A brief case of Japanese lesson study
Looking back: What progress has occurred in U.S. lesson study?
Looking forward: What progress is needed in U.S. lesson study?
Does Netherlands have similar challenges and progress?
Lesson Study
授業研究 jugyou kenkyuu

授業 (jugyou)=live instruction, lessons, lesson
研究 (kenkyuu)=research, investigation, study

“Lesson study” may not be optimal translation
Lesson Study Cycle

1. STUDY
   Study content, curriculum and standards
   Consider long-term goals for student learning and development

2. PLAN
   Select research lesson
   Anticipate student thinking
   Plan data collection and lesson

3. DO RESEARCH LESSON
   One team member teaches, others collect data

4. REFLECT
   Share data
   What was learned about student learning?
   What are implications for this unit and more broadly?
   What learnings and new questions do we want to carry forward in our work?
What is a Research Lesson?

1. Actual classroom lesson with students, watched by other teachers
2. Planned (often collaboratively) by anticipating student thinking
3. Brings to life a goal or vision of education
4. Recorded: video, audio, student work
5. Discussed by school faculty and sometimes outside commentators
Research Lessons in Japan

Source: (Japan) National Education Policy Research Institute, 2011
Example
Komae #7 Elementary School
School-wide Lesson Study
Choosing a Lesson Study Theme

Think about the students you serve.

Your Ideals:

What qualities would you like these students to have 5-10 years from now?
Choosing a Lesson Study Theme

Think about the students you serve.

The Actual:
List their qualities now.
Choosing a Lesson Study Theme

What is a gap between the ideal and the actual that you would really like to work on as an educator?
Lesson Study Research Theme at Komae School

The Research Theme (long-term goal)

State *positively* the ideal student qualities you hope to build. For example:

“For students to:
- value friendship
- develop their own perspectives and ways of thinking
- and enjoy science.”
**School’s Educational Goals**
- Considerate
- Think well and try hard
- Healthy
- Can lead ordered lives

**Ideal Profile of Students**
- Learn with friends
- Experience natural world richly
- Have own perspectives and ways of thinking

**Actual Situation of Students**
- Most are cheerful, kind and gentle
- Friendships are shallow, and capacity to think about things from another person’s idea and perspective is inadequately developed
- Have considerable difficulty holding their own perspectives and ideas
- Some students lack interest in the natural world around them

**RESEARCH FOCUS**
For students to value friendship at the same time that they develop their own perspectives and ways of thinking
- Toward enjoyable science and life environment studies -

**Ideal Profile of Students of Research Groups**

**Lower Grades**
- Participate happily in learning
- Develop their own strategies
- Learn with friends

**Middle Grades**
- Eagerly use their 5 senses
- Make predictions and test them
- Learn through comparing their own ideas with friends’ ideas
- Cooperate with friends while carrying out activities

**Upper Grades**
- Get pleasure from solving problems
- Can find problems and make predictions
- Can have their own ideas in observations and experiments
- Value learning with friends in which they recognize each others perspectives

**Research Hypotheses**
- If students are eager to learn and take initiative in their learning, they will be able to deepen their own perspectives and ways of thinking
- Students will develop considerate hearts if they work together in ways that enable them to recognize one another’s ideals as they engage in observations, experiments, and activities

**Methods and Measures**
1. Strategies for Curriculum
2. Strategies for Learning Materials
3. Strategies for Teaching and Evaluation
4. Strategies for Learning Activities
Student plans (from lesson 1) for lifting the weight. These plans were included in the packet for the research lesson. Student writing is in regular typeface; teacher’s comments are in capitals.
From Instructional Plan

• Levers unit goals (from national standards)
  – Placement of weight changes angle of lever (even though weight remains constant)
  – Names of lever parts
  – Relationship between position of effort and amount of effort needed to lift a given weight

• Data collection
  – “Tsubuyaki” and worksheets: Do students grasp problem, predict, verify, consolidate, grasp new problem?
Planning Segment:

What are the similarities and differences between this planning and planning familiar to you?
How does lesson study improve instruction?

Visible Features of Lesson Study

• Planning
• Curriculum Study
• Research Lesson
• Data Collection
• Discussion
• Revision
• Etc.

Instructional Improvement
A Common Misconception (or Partial Conception) of Lesson Study

Visible Features of Lesson Study
- Plan
- Teach
- Observe
- Discuss
- Etc.

Key Pathway
- Improve Just One Lesson Plan

Instructional Improvement
How Does Lesson Study Improve Instruction?

Visible Features of Lesson Study

- Planning
- Curriculum Study
- Research Lesson
- Data Collection
- Discussion
- Revision
- Etc.

Pathways

- Teachers’ Knowledge
- Teachers’ Beliefs
- Teachers’ Collaboration & Professional Community
- Teaching-Learning Resources

Instructional Improvement
How Did the Lesson Study Cycle Affect Teachers’ Knowledge, Beliefs, Professional Community?

• Partner chat
Study Curriculum Content, Teaching Materials, Student Learning Goals

Plan Research Lesson Unit

Reflect On Data, Analyze Student Work From Lesson

Do Research Lesson, Collect Data Observe Students and Instruction

- Thrill of research
- Understand colleagues’ ideas
- See impact of innovation
- See how students use prior years’ learning
- Grasp student experience
- Take a risk
- Observe different class norms and routines

Notice Content Difficulties
Study Curriculum
Connect daily instruction to long-term goals

Build Lesson Rationale
Negotiate with Colleagues
Anticipate Student Thinking
Do Activity
Progress 1 in the U.S.:

• Understanding that lesson study is not just about improving lesson plans
Progress 2 in U.S.

- Curriculum (and Content) Study Kyouzai Kenkyuu (教材研究)
- But not all U.S. materials support good curriculum study!
Introduction to Rectangle Area
Tokyo Shoseki Grade 3
Available at http://www.koyopublishing.com/
Introduction to Rectangle Area

“...in teaching area, it is important to take four steps, i.e., direct comparison, indirect comparison, non-standard unit, and standard unit. To promote taking these steps, a rectangle and square without grids are used.”

A Japanese Teacher’s Edition

“area is the number of square units needed to cover a surface”

A U.S. Teacher’s Edition
Percent of Sentences in Teacher’s Edition on Selected Topics (Chapters on Area of Polygons)

<table>
<thead>
<tr>
<th>Reason for Pedagogical Choices</th>
<th>Japan</th>
<th>US</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anticipation of Varied Student Thinking</td>
<td>28%</td>
<td>1%</td>
</tr>
<tr>
<td>Single Correct Student Answer</td>
<td>3%</td>
<td>13%</td>
</tr>
</tbody>
</table>
What we learned:

• Find a high-quality curriculum to compare with your own
• Ask why it is designed as it is
• What is the unit flow?
• How will students think?
• What powerful experiences will give students an aha?
Progress 3: Teacher-led spread of ideas through lesson study

- For example, 26-district “Silicon Valley Mathematics Network” (SVMI)
- Teachers spread strategy of “re-engagement”: Showing and discussing contrasting examples of student work at beginning of lesson
An Example of Teacher-led Knowledge Spread Through Lesson Study

“Show me a 4 X 5 Rectangle on Geoboard”
What was the student on the left thinking?
I just add 15 to 10 cm to get to 25 cm. So then I added 15 to 16 cm to get 31 cm.

I found this by dividing 25 by 10 to see what relationship they had. $25 \div 10 = 2.5$ so $10 \times 2.5 = 25$. So I multiplied $16 \times 2.5$ and got 40 cm.
“Re-engagement” Spread

Across at least 7 school districts, elementary and secondary, several subject areas, led by teachers, and improved by them.

Used by teachers for different purposes
- to recall prior content
- to explore misconceptions
- to strengthen fragile understandings
- become meta-cognitive
Progress 4: Rigorous Research on Lesson Study

- Randomized, controlled trial of 39 lesson study groups across the U.S., 1,059 students
- Mathematical resource kit to support lesson study on fractions was mailed out to them
- Teams self-managed lesson study

Common U.S. Challenges in Understanding Fractions
(What about Netherlands?)

- Seeing fraction as number ("I can’t put 2/3 on number line because it’s two different numbers")

- Understanding the size of the denominator (that 1/6 is smaller than 1/5)

- Knowing what is the whole (construct whole from a fraction)

- Seeing that fractions can be greater than one
What are the Affordances of Each Model?

Area of circle

Area of rectangle

Part of a set

Linear measurement
Linear Measurement Context Might Help Students See Fractions as Numbers on Number Line

Length helps students attend to magnitude of fractions (how much) rather than just count pieces (how many)
Lesson Study Resource Kit Mailed Out To Groups

1. Mathematics tasks to solve and discuss, research results and student work to analyze

2. Curriculum inquiry: Japanese textbook, Takahashi lesson video, teachers’ materials

3. Lesson study materials (template for lesson plan, protocol for discussion, etc.)

4. Suggested teacher-led inquiry process to explore and use resource kit
Second tree. How can we express the “extra” as meters?
Students solve. Observers Record
Day 2: Introduction

Day 2 Lesson with Dr. T
North Shore TR 3 → 3 miles
Lakefront \(\frac{1}{4}\) → One fourth mile

The fractional part of the tape fit 3 times exact:

→ 1 third meter

→ 1 half m (meter)

→ 1 fifth m (meter)
Day 2: 2/5 m Mystery Strip
Teachers try a problem: Find the length of the mystery strip
Impact Assessment

Teachers’ Knowledge of Fractions
33-item teacher assessment, from Univ. of Michigan LMT (21 items); Univ. of Louisville; New Zealand, etc.

Students’ Knowledge of Fractions
17-41 item (grade 2-5) student assessment (NAEP, California standards, curriculum materials, research studies)

Teachers’ Beliefs and Dispositions, e.g.
- effectiveness of collegial learning (5 items)
- expectations for student achievement (7 items)
Survey Item Examples

Perceived Effectiveness of Collegial Learning in Mathematics

*I have learned a lot about student thinking by working with colleagues* (4 items)

Expectations for Student Achievement

*No matter how hard I try, some students will not be able to learn aspects of mathematics* [reversed item] (7 items)
HLM Analyses: Impact of LS with Resource Kit on Teachers’ Beliefs

Significant Positive Impact on:
- Teachers’ Fractions Knowledge
- Students’ Fractions Knowledge
- Perceived Effectiveness of Learning with Colleagues
- Expectations for Student Achievement
“What Works Clearinghouse” criteria review of 643 mathematics professional learning studies

• Only 2 met their design criteria and showed impact on student mathematical proficiency

• One was our RCT of lesson study, supported by mathematical resource kit on fractions

(Gersten et al., 2014)
Looking Forward: What is Missing in the U.S.?

• 4 synergistic types of lesson study
• School-wide lesson study
• Feedback of lesson study into textbooks
In Japan, 4 Types of Lesson Study Work in Synergy for System-Wide Change

• School-wide (Shared school-wide theme)
• District-level (Cross-school, by subject)
• National School-based
• Association-sponsored
Synergy Among 4 Types

• National schools and associations have access to latest innovations from around the world
• Local teachers know their students and colleagues
• District-level group for local ongoing leadership of subject (math, language, art, physical education, science music, etc.)
Japanese Teachers Use Lesson Study to Study and Spread

- **New Contents**, e.g., solar energy (Lewis, 2010), 30% increase in math content (Takahashi, 2012)

- **New Instructional Approaches**, e.g., Inquiry, Structured Problem-solving (Stigler & Hiebert, 1999)
A story about introduction of solar energy in the Japanese elementary science curriculum in the 1990’s…

- Hundreds of elementary schools applied for small grants as “designated research schools” on how to teach solar energy

- After about a year of experimentation, often in collaboration with university-based colleagues, schools brought to life their thinking in large public research lessons
Solar energy, cont’d

• Thousands of educators saw these research lessons and questioned teachers about why they chose these approaches, what had worked and hadn’t.

• Knowledge quickly spread about the science content itself, good teaching materials (what toys work and don’t to illuminate the principles), and student thinking.
Solar energy, cont’d

A teacher observing a public research lesson asked about three student strategies she saw:

– moving a solar cell closer to a light source
– adding a second light source
– using a magnifying class to “concentrate” light

“I want to know whether the three conditions the children described — ‘to put the solar cell closer to the light source,’ ‘to make the light stronger’ and to ‘gather the light’ — would all be considered the same thing by scientists. They don’t seem the same to me. But I want to ask the teachers who know science whether scientists would regard them as the same thing.”
We feel there is a great value in a public lesson. It is an opportunity to put our work out for public scrutiny.

High School Teacher, Massachusetts
What Is Missing in U.S. Lesson? (2)

- School-wide lesson study can improve student achievement
- But is very rare
- We are currently trying to build “Collaborative Lesson Research” in several schools in each of OUSD, SFUSD, CPS, with attention to systematic sharing of knowledge within and beyond the school
Schoolwide Lesson Study School

Looking Forward: What is Missing in the U.S.?

- Feedback of lesson study into textbooks
Teachers’ Activities to Improve Instruction

Choose curriculum, write curriculum, align curriculum, write local standards

Plan lessons individually

Plan lessons collaboratively

Watch and discuss each other’s classroom lessons
Teachers’ Reflections

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 Teacher, Florida
Teachers’ Reflections

The lesson study has taught me: We must never assume that all students understand. It was observed several times that even our "good" students did not have full understanding….Lesson study is staff development in its purest form. Rich discussion occurs. Team members are allowed to be creative, curious, self-motivated participants. The team building was incredible.”

Elementary Teacher, NY #562
Thank you!

Catherine Lewis clewis@mills.edu

More information at:
www.lessonresearch.net

Matsuzawa School Report:

Implementing a New National Curriculum: A Japanese Public School’s Two-Year Lesson-Study Project.

Japanese mathematics series (for charge) at www.globaledresources.com