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Project for International Math-teacher Professionalization Using Lesson Study (IMPULS)

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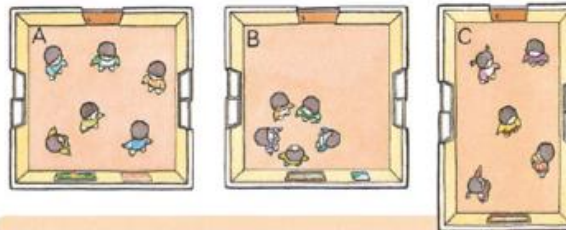
Teaching through Problem Solving



► Crowdedness

- 1 Kiyoshi and his friends will sleep in cabins A, B and C at camp.

Which cabin is the most crowded?



- 2 Let's think about how we can figure out how crowded something is!

What is Lesson Study?

As Professor Fuji (2014) said,
“lesson study is like air”
for Japanese teachers

Three Levels of Teaching

Japanese mathematics educators and teachers identify three levels of expertise of mathematics teaching:

- Level 1: The teacher can tell students the important basic ideas of mathematics such as facts, concepts, and procedures.
- Level 2: The teacher can explain the meanings and reasons of the important basic ideas of mathematics in order for students to understand them.
- Level 3: The teacher can provide students with opportunities to understand these basic ideas, and support their learning so that the students become independent learners.

(Sugiyama, Y. 2008, Trans. Takahashi, A., 2011a)

What we observed

- In the LS cycle teachers collaboratively plan a lesson, observe, and then analyse, reflect and discuss these observations in a post lesson discussion (Fernandez and Yoshida, 2004). The purpose of LS is not to produce the perfect lesson but to improve teaching.
- The LS cycle is not seen as final. It is not supposed to give an answer to a question but to provide a deeper understanding of a difficult issue (Fuji, 2014).

- LS the teachers have a shared focus, a research question, the “knowledgeable other” helps to focus on the research question. The knowledgeable other, being an expert teacher and/or a researcher, has the role of facilitating the enquiry and guiding teachers in their pursuit, which might involve giving them further reading to reflect on after the lesson
- Collaborative approach

Kyozai---kenkyu

教材 研究

- In Japan, teachers will do a lot of groundwork before developing a research LS lesson plan, this investigation is called 教材 研究, which means studying in Japanese.
- Various teachers guides are compared.
- Teaching methods will be compared.
- Variety of resources will be considered.
- Related **research articles** about the topic will be read and discussed. It is assumed that this is an integral part of everyday teaching practice as this helps teachers to develop their knowledge to become Level 2 and 3 teachers.

Critical part of the planning process

- The planning discussions will examine deeply what the pupils need to learn and understand during the lesson.
- What they have learned previously.
- The major focus of the lesson, all objectives must be clearly stated.
- The way the pupils will be helped to accomplish the objective.

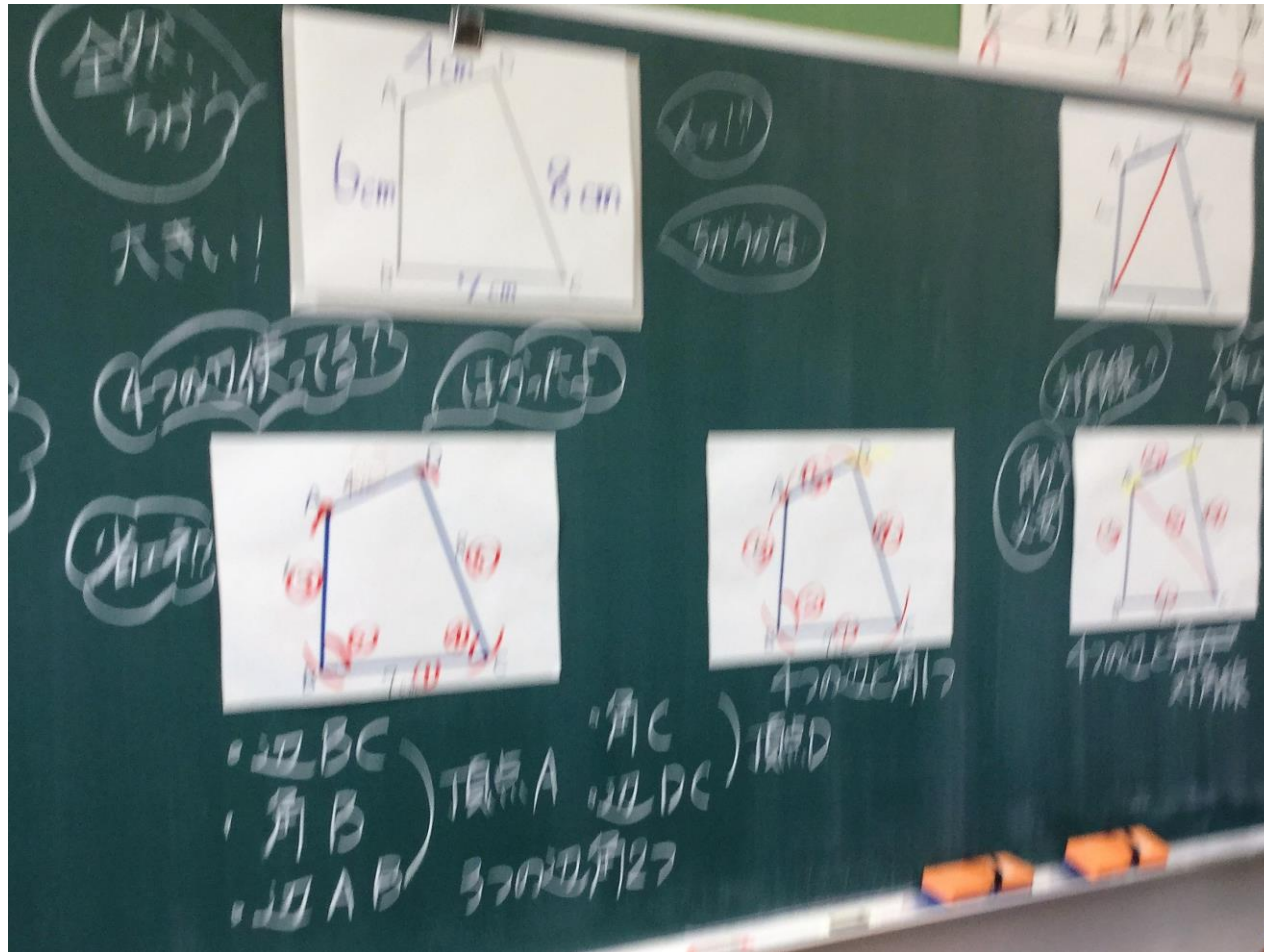
Example of a Typical LS lesson planning process

- Prior to Meeting 1- LS Team formed and the research question for the lesson is decided.
- Meeting 1 - Draft lesson plan written. (1/6/15)
- Meeting 2 - Revision of draft lesson plan. (3/6/15)
- Meeting 3 - Further revision of draft lesson plan (11/6/15)
- Meeting 4 - LS Team and the School Research Promotion Committee (which may include the 'knowledgable other' meet to finalise draft lesson plan. (16/6/25)
- 1st Mock Up lesson – The teacher selected to teach the LS lesson teaches the lesson to the research team and other teachers in the school, with the teachers playing the role of pupils. This then informs further revision of the lesson plan. (17/6/15)
- Meeting 5 – Further revision of lesson plan based on feedback from teachers and observers involved in the mock up lesson. (18/6/15)
- 2nd Mock Up lesson – LS lesson taught again to another class, with LS team observing. (21/6/15)
- Meeting 6 – Final meeting to revise lesson plan. (22/6/15)
- Research LS lesson taught – Observers include LS team, School principal, IMPULS participants, Tokyo Gakugei University professors (24/6/15)
- Post Lesson discussion (24/6/15)

- In all lessons we observed in Japan great importance was given to developing learners' mathematical thinking. This was achieved through careful questioning and skilled use of board work.



Board Writing is used as a tool for teaching through problem solving

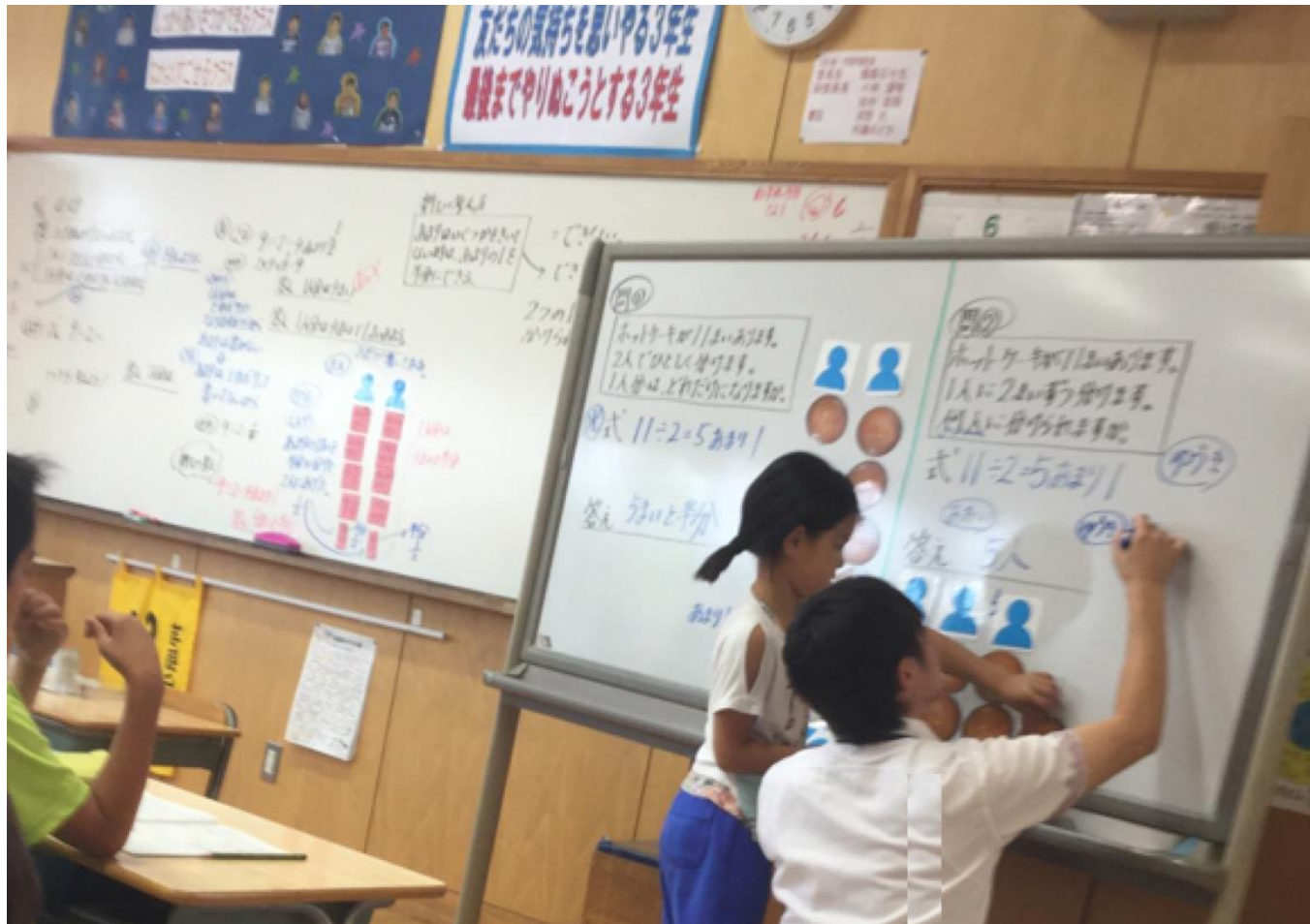


Board Writing

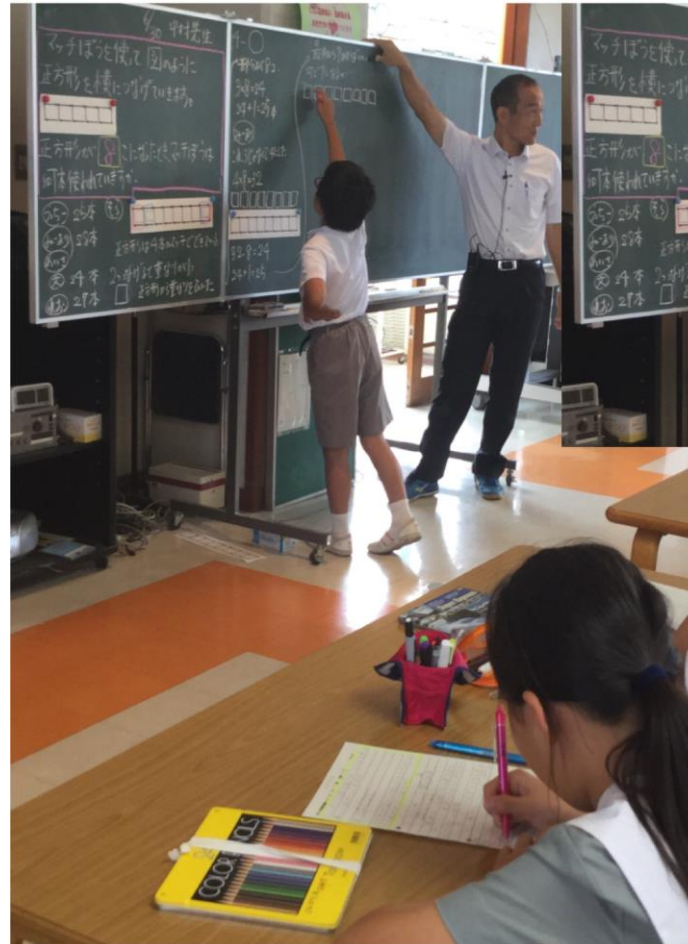
In addition to providing a record of the problem, the solution methods and the principles discussed during the lesson, board writing can be used;

- To support pupils to visualise the discussion and development of the topic.
- To connect parts of the lesson coherently together in order to build understanding.
- To support pupil skills for notetaking.

Pupils encouraged to share ideas at the board



Pupils encouraged to share ideas at the board



As there was a lot of time to discuss only one question the teacher could ask some very deep questions and encourage children to really think mathematically.

In one lesson we observed the solution to the problem was not even achieved during the lesson.

- Our Japanese colleagues have the advantage that curriculum change is introduced slowly after careful consideration. I was surprised that the new version of the mathematics curriculum was announced in March 2008 and only implemented in April 2011 (Takahashi, 2014). This gave experts plenty of time to consult with teachers, do LS and write the textbooks.
- Lesson Study and subject knowledge

Lesson Study video

<https://youtu.be/JMiIRro86E>



2

In Nishikawa City, each person produced 800g of waste each day last year. This is 125% of the amount produced 10 years ago.



What was the amount of waste produced 10 years ago?

5th grade B p.66

$$800 \times 1.25$$

$$800 \div 1.25$$

$$1.25 \div 800$$

$$1.25 \times 800$$

What type of division, fair share (how many in each) or repeated subtraction (how many groups)?

**2**

In Nishikawa City, each person produced 800g of waste each day last year. This is 125% of the amount produced 10 years ago.

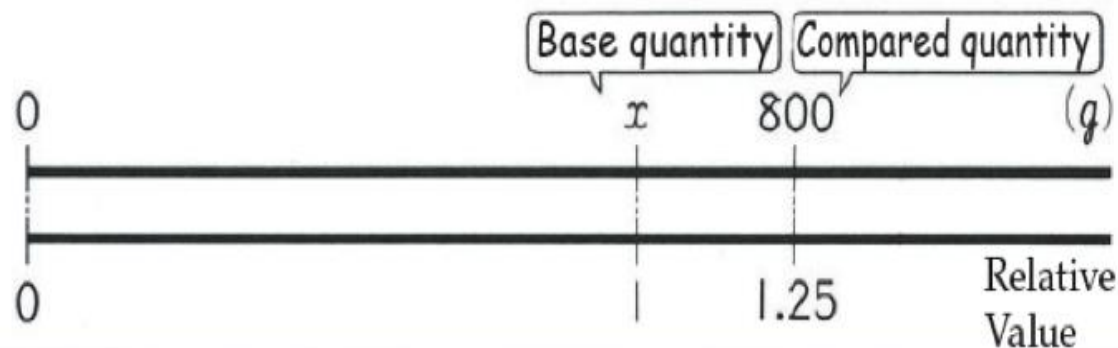


What was the amount of waste produced 10 years ago?

5th grade B p.66



Let's think about how to find the base quantity!



$$x \times 1.25 = 800$$

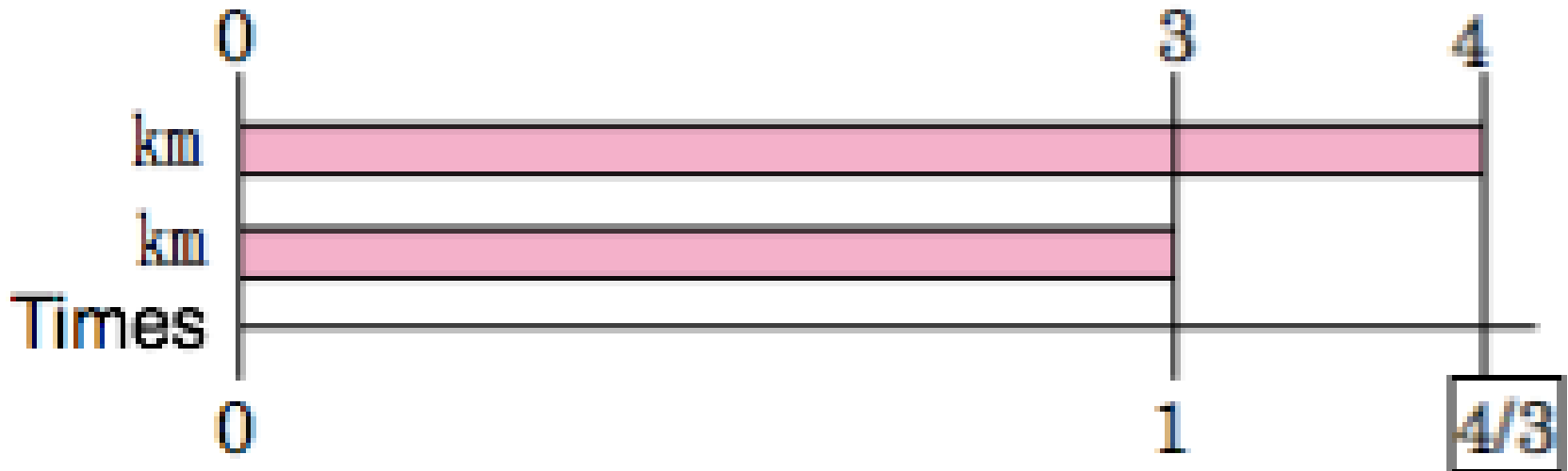
$$800 \div 1.25$$

Times as much

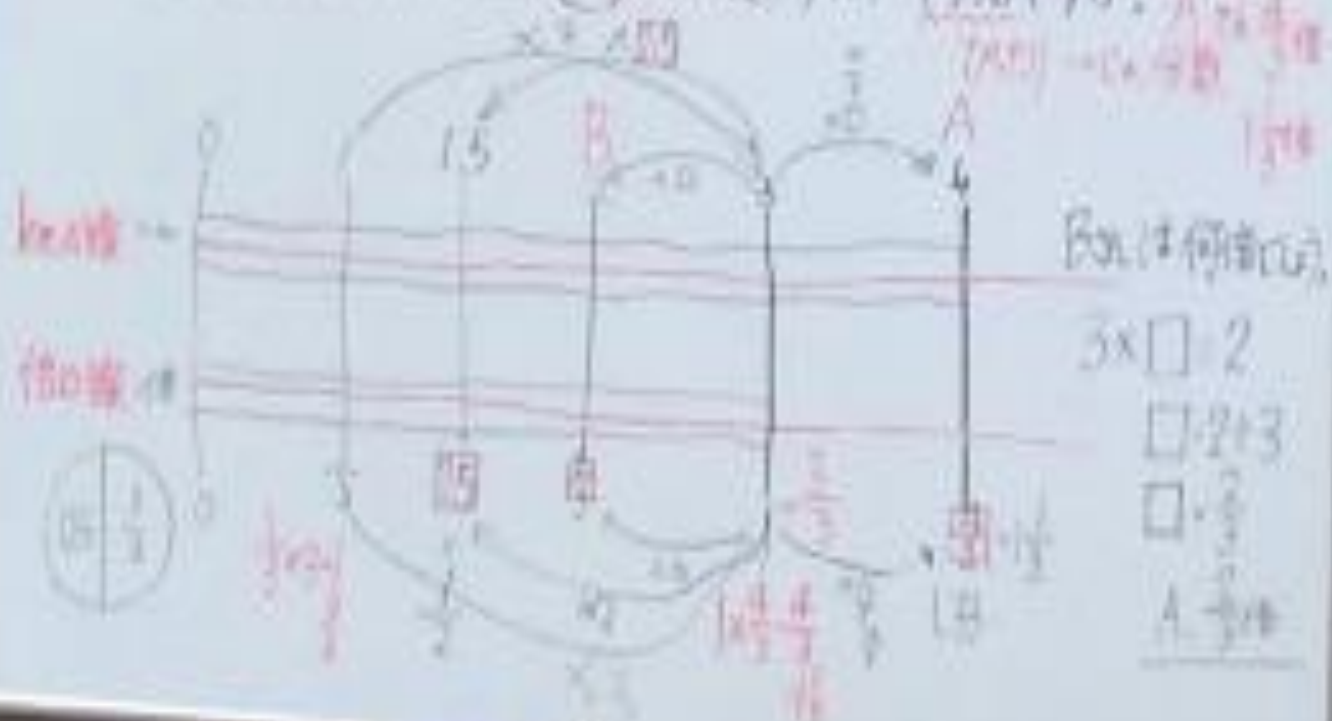
The distance between my home and the school is 3km. Compared to that distance, how many times as much is ____'s house?"

4km, 2km, 3km, and 1.5km

‘2 times as much’ between 4km and 2km



先生の道のりをもとにすると、(A)の道のりは、何倍ですか。 $\frac{D_{A}}{D_{B}} = \frac{0.75}{0.5} = 1.5$



A Research Lesson



Lesson Note

We were introduced to the Lesson Note app which we used during lesson observations in Japan.

