Lessons from Japanese Math Education

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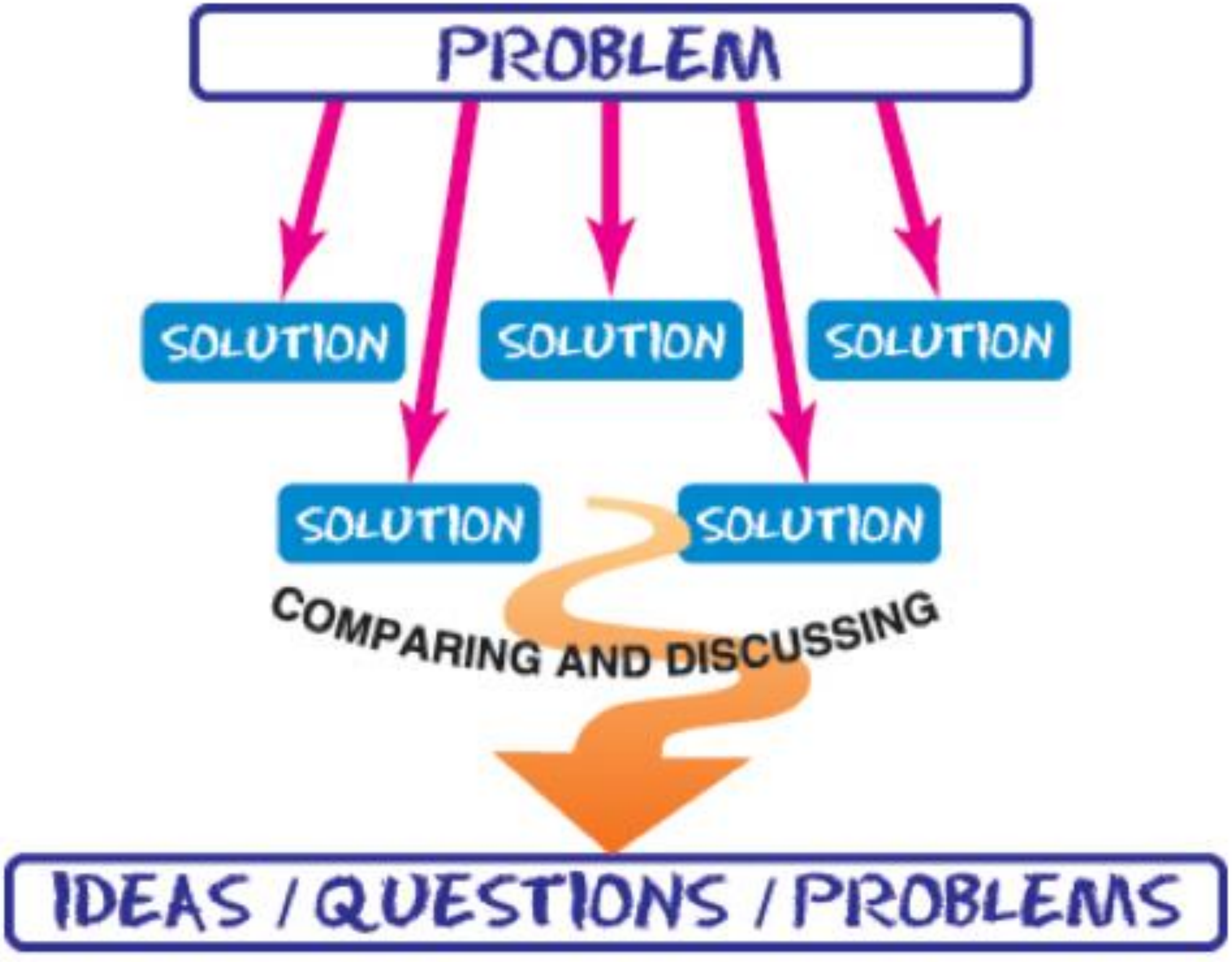
TIMSS

- Trends in International Mathematics and Science Study (TIMSS)
- Largest and most comprehensive international study of educational achievement
- Math and science curricula "both as they are intended and as they are actually delivered in the classrooms, and as they are learned by students"
- Comparison and analysis of curricula (textbooks and curriculum documents), teacher practices (interviews and filmed classes), and student achievement (over half a million students aged 9, 13 and 16 in nearly 50 countries have been tested).
- Administration years: 1995,1999, 2003, 2007, 2011, 2015).

TIMSS Findings

Typical Year 9 U.S. mathematics lesson	Typical Year 9 Japanese mathematics lesson
is with a class set by ability	is with a mixed-ability class
relies on a textbook	begins with a complex problem
focuses on developing a mathematical skill	focuses on developing mathematical thinking
devotes most available time to practising routine procedures	devotes most time to mathematical reasoning and understanding
features isolated tasks	makes explicit links between concepts

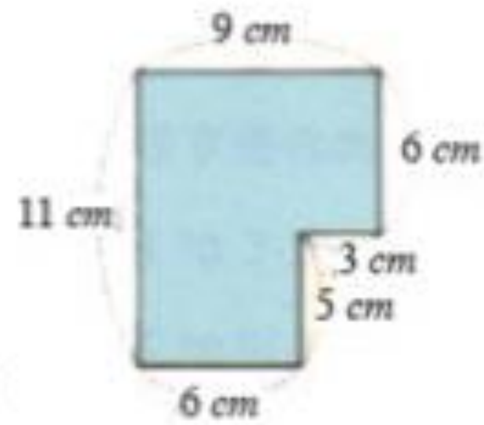
Lessons in Japan: Structured Problem Solving



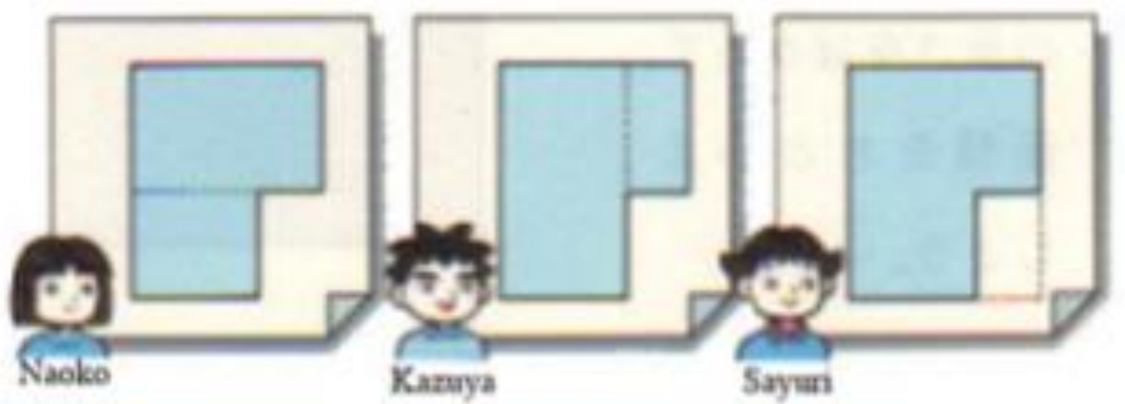
Structured Problem Solving: An Example

▶ **Ideas for Finding the Area**

2 Let's think of a way to find the area of the shape on the right.



① Let's explain each friend's way of thinking.



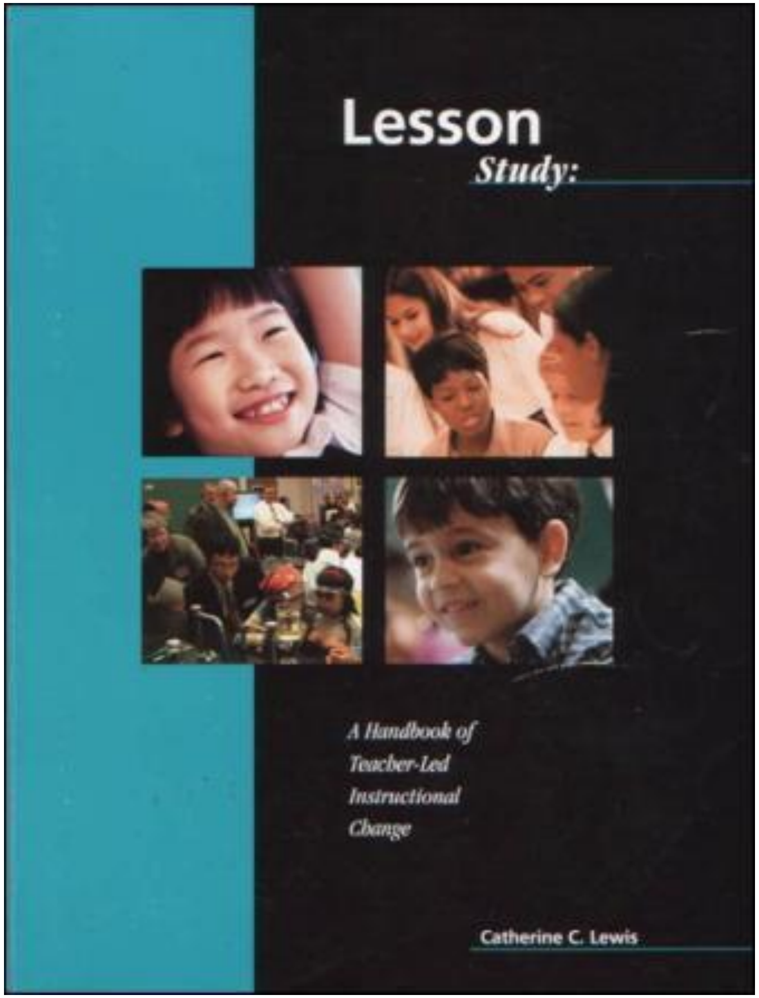
② Let's find the area using each method.

Lesson Study in Mathematics: Its potential for for fostering deep professional learning by math teachers

and educational improvement in mathematics

Lesson Study in Japan

- Whole-school, long-term PD
- Supported at all levels of the school & by educational agencies beyond the school
- Direct relationship to the National Course of Study (curriculum)
- Its focus is on the improvement of teaching and learning



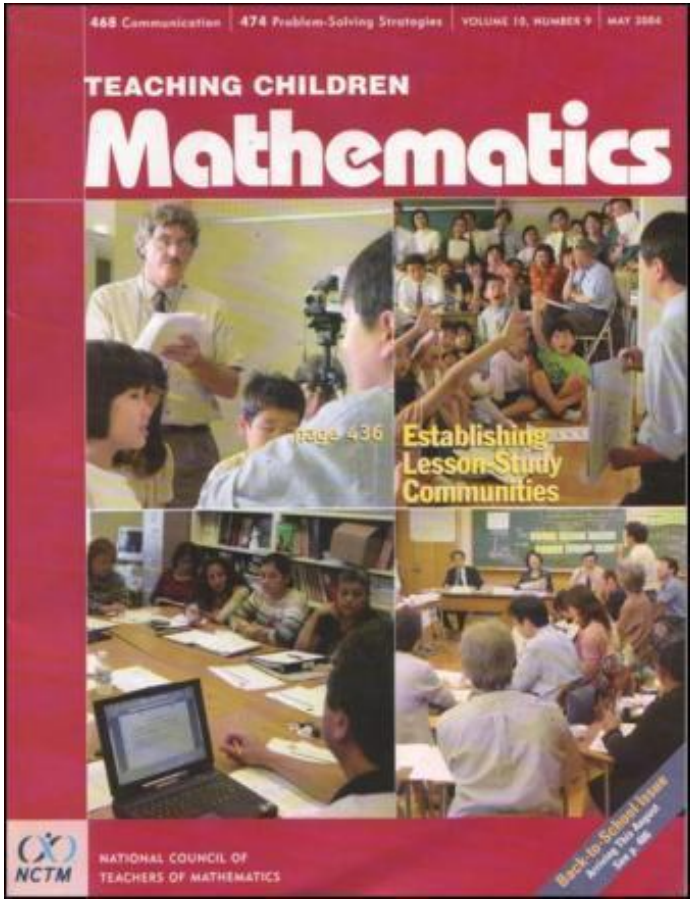
Lesson Study:

A Handbook of Teacher-Led Instructional Change

Catherine Lewis (2002)

Research for

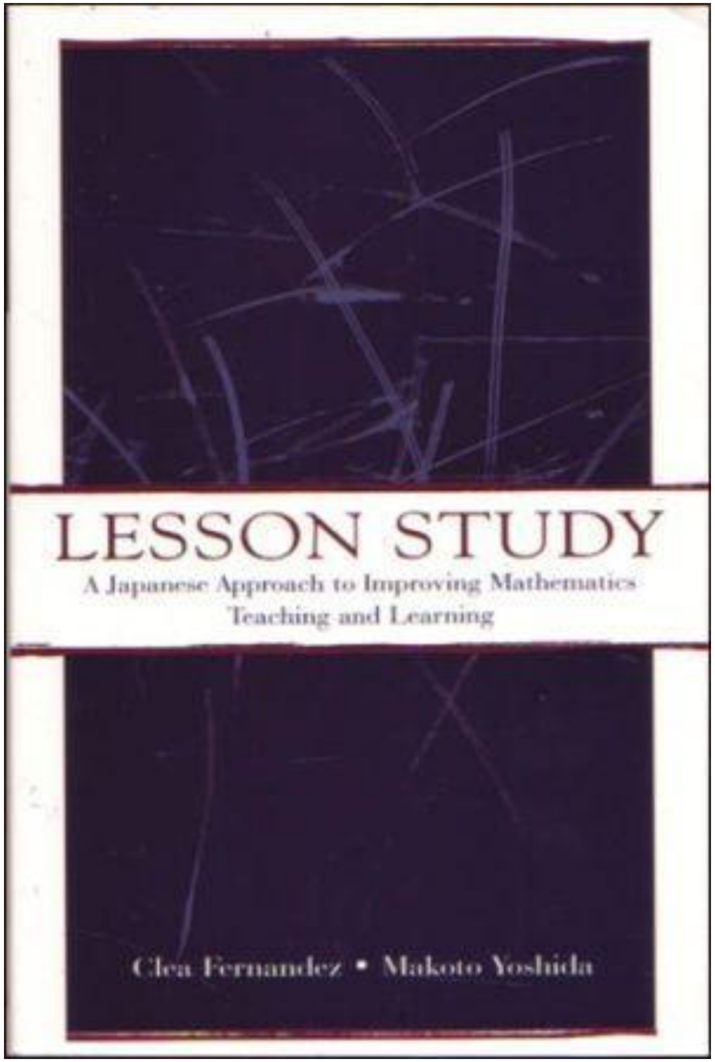
Better Schools



“Ideas for Establishing Lesson Study Communities”

Takahashi & Yoshida

Teaching Children Mathematics, May, 2004 (NCTM)

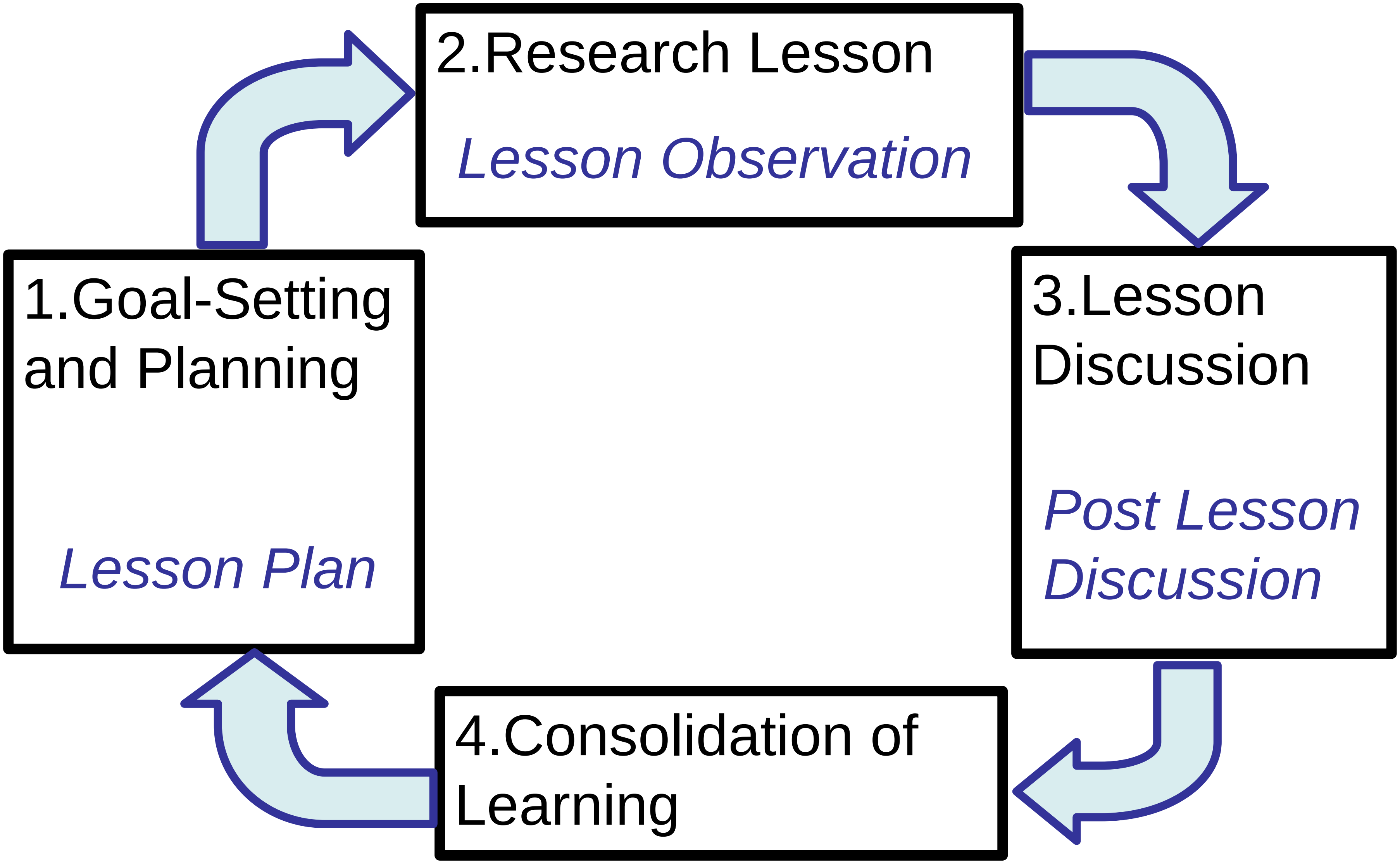


Lesson Study: A Japanese Approach to Improving Mathematics Teaching and Learning

Fernandez & Yoshida (2004)

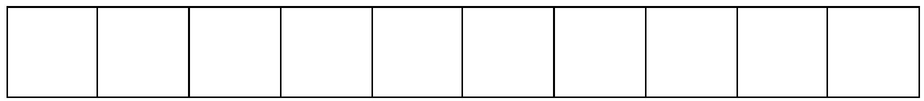
Lawrence Erlbaum Associates, Publishers

Lesson Study Cycle (Lewis (2002)

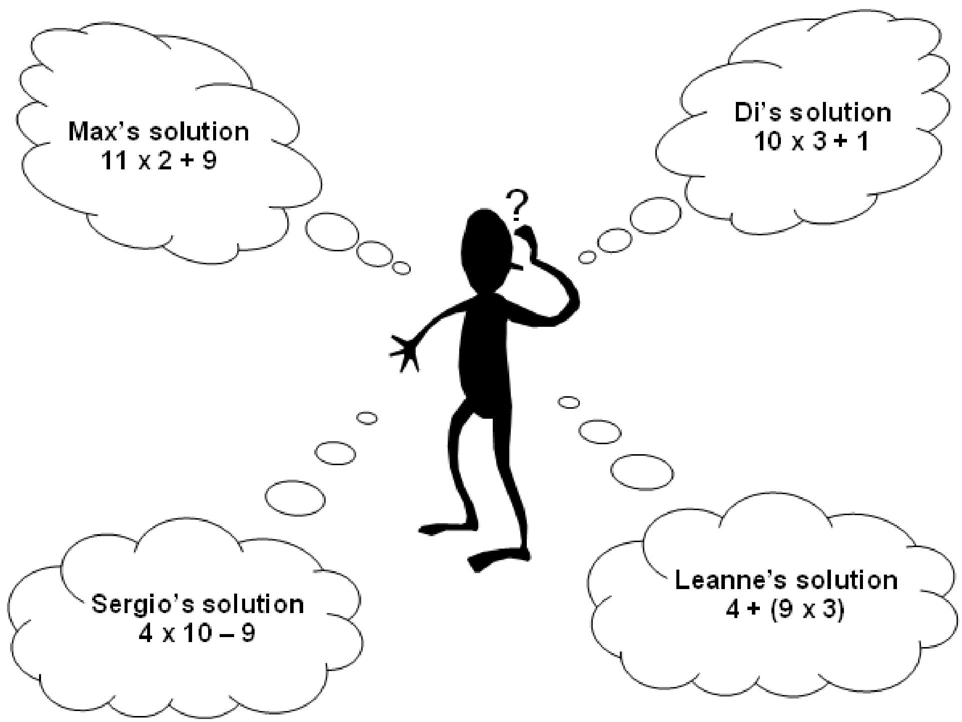


A Mathematically Rich Task

Without counting, can you work out how many matchsticks were needed to make 10 cells?



Four students gave different solutions which are shown below.



A Mathematically Rich Task

Part A

Do these four strategies give a correct result?

Part B

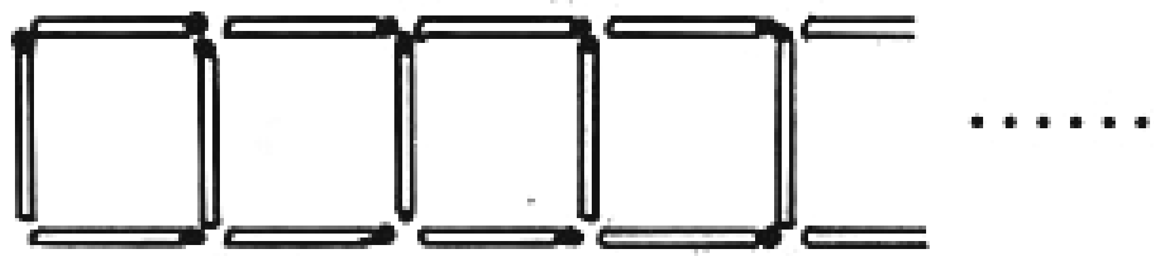
How many matchsticks would be needed to make 5 cells, 12 cells, 27 cells? Explain your thinking.

Part C

Choose 2 of the above strategies. How do you think the person arrived at his or her strategy? Explain the thinking involved.

Number of Matchsticks (Grade 4, 6)

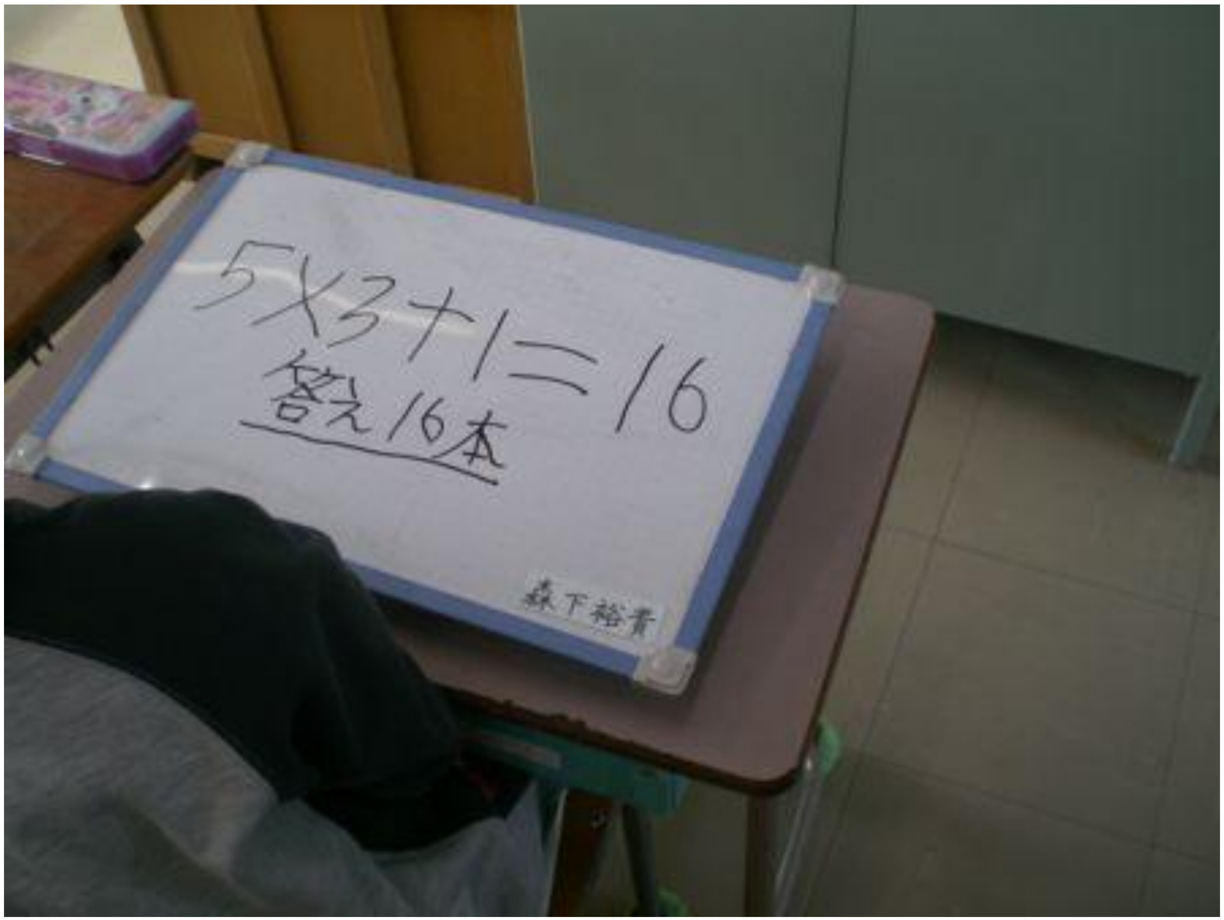
- Squares are made by using matchsticks as shown in the picture. When the number of squares is five, how many matchsticks are used?



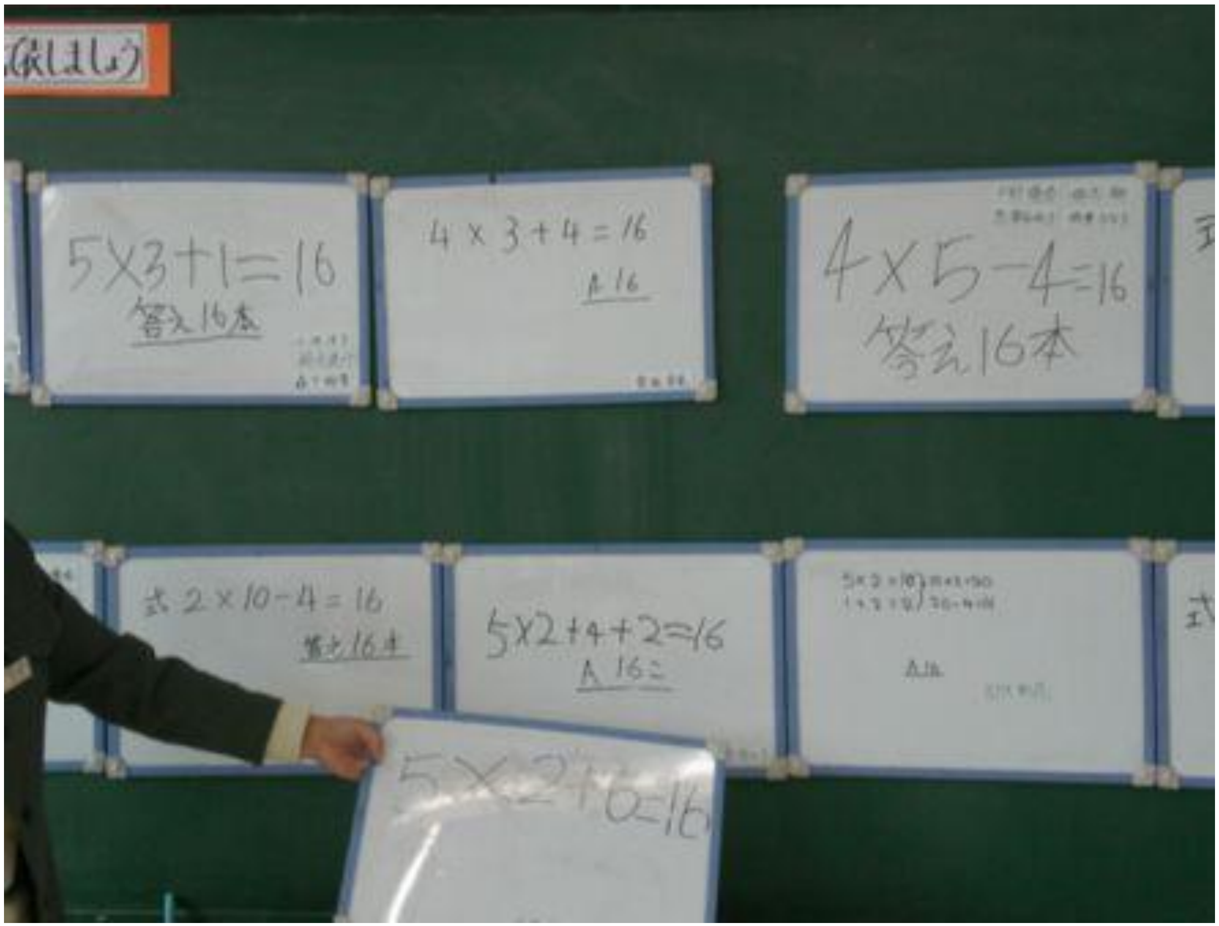
(1)Write your way of solution and the answer.

(2)Now make up your own problems like the one above and write them down.

Students work is written on magnetic boards that are easy to display for the whole class



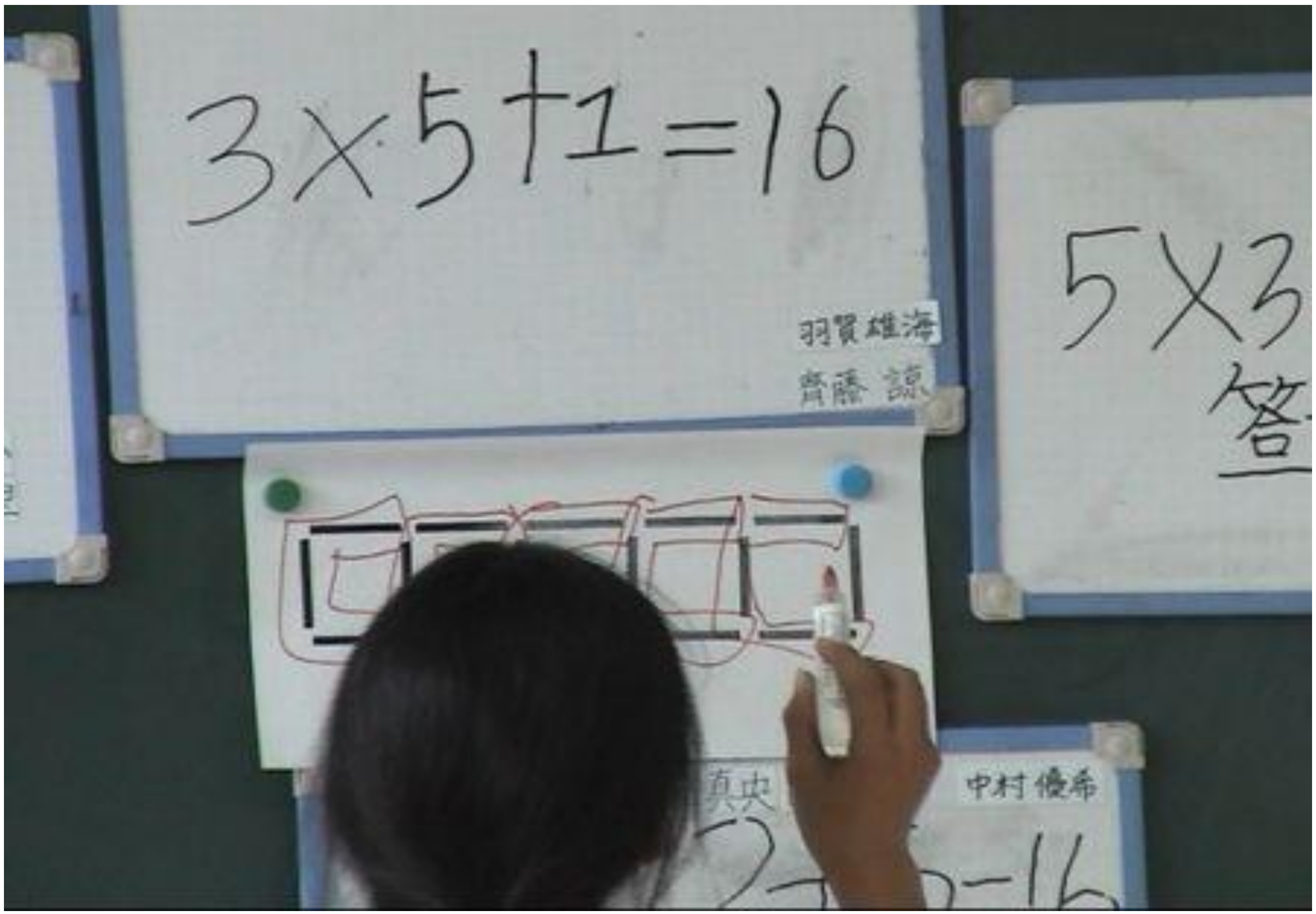
Teacher has carefully selected children's solutions for whole class discussion

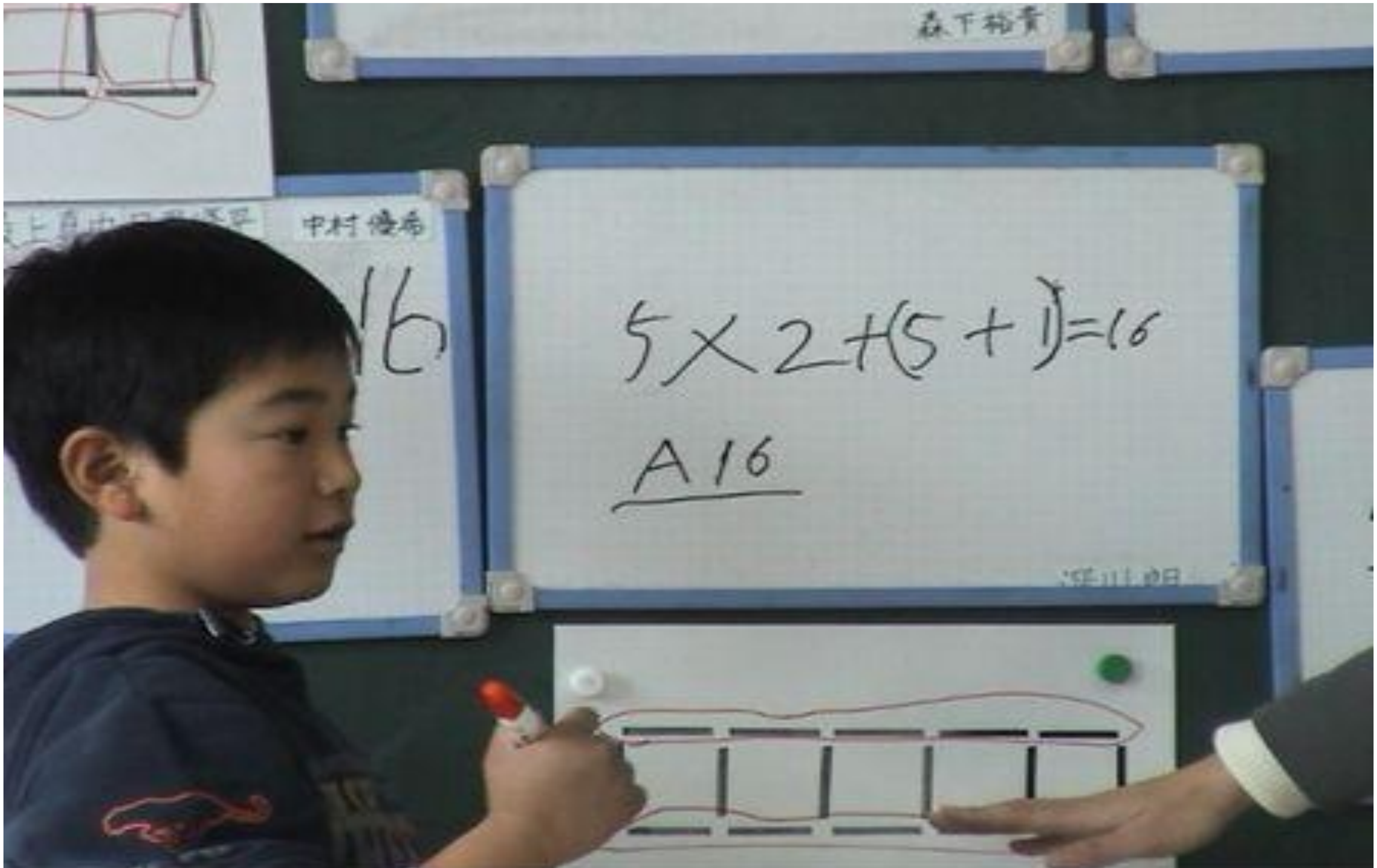


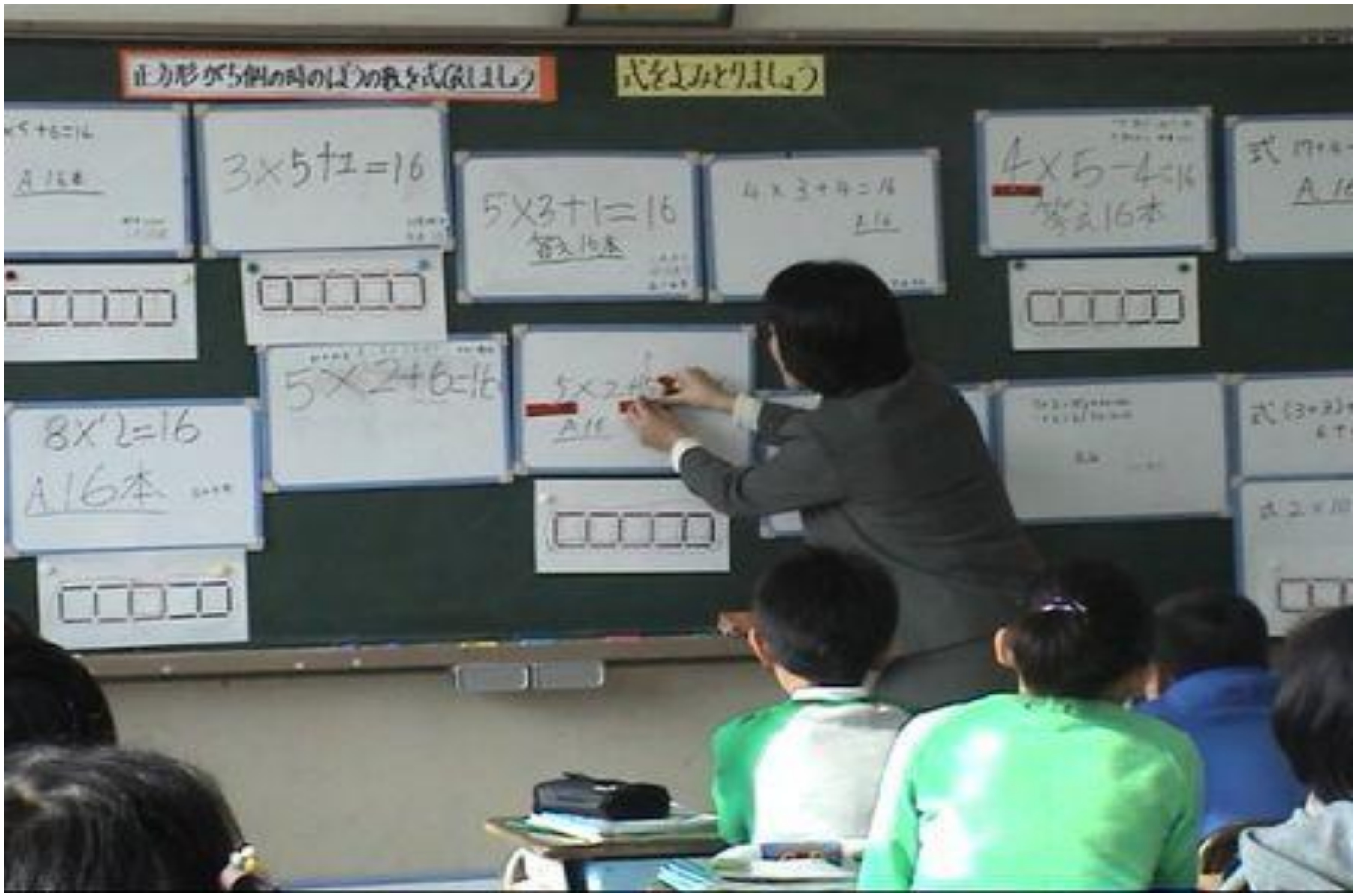
Observers have the teacher's detailed lesson plan and are looking at how children and teacher are moving ahead according to the plan

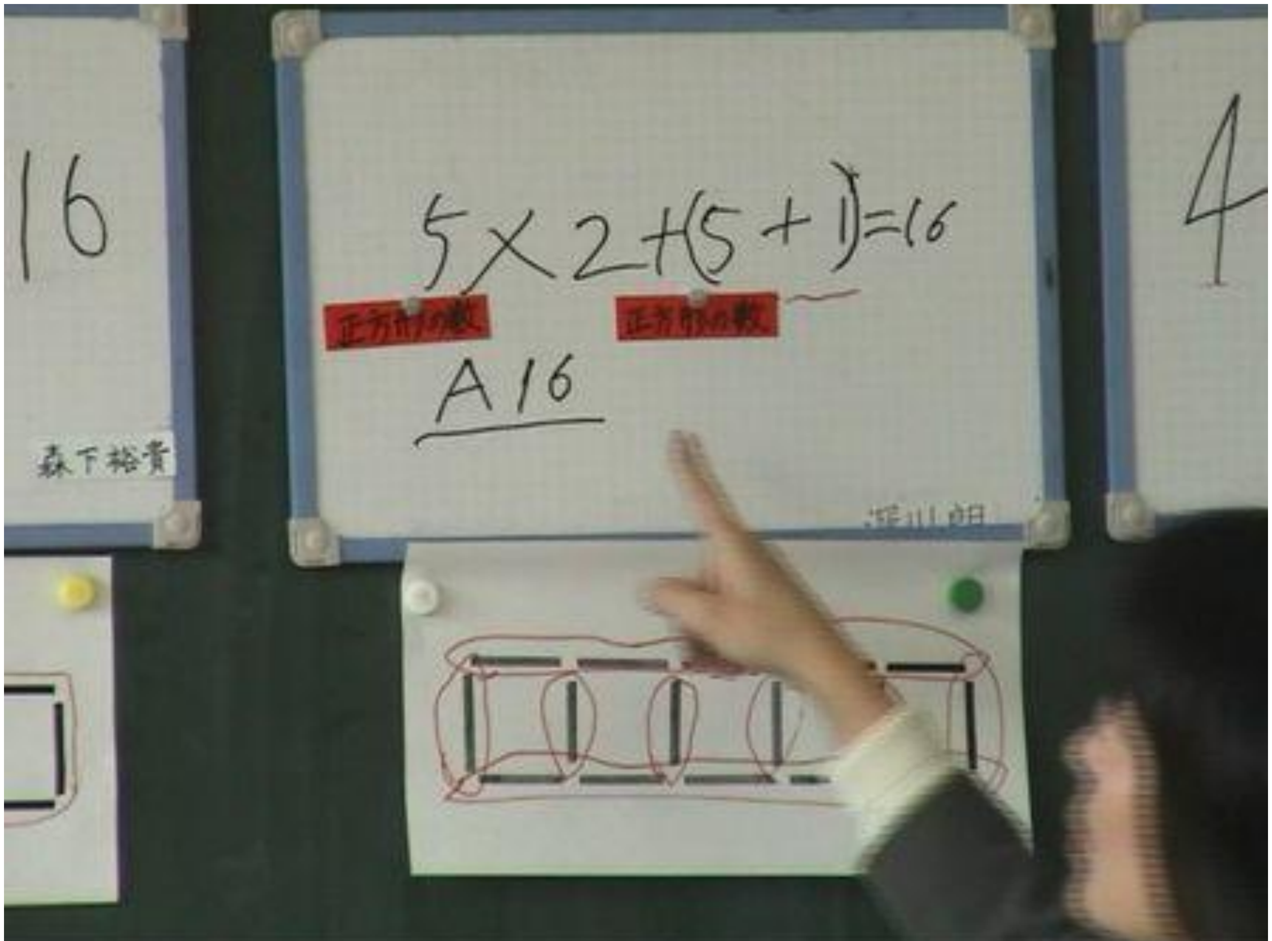
The teacher asked student to explain the work of another student using geometrical figures

This student is explaining her visual thinking that supports her generalisation

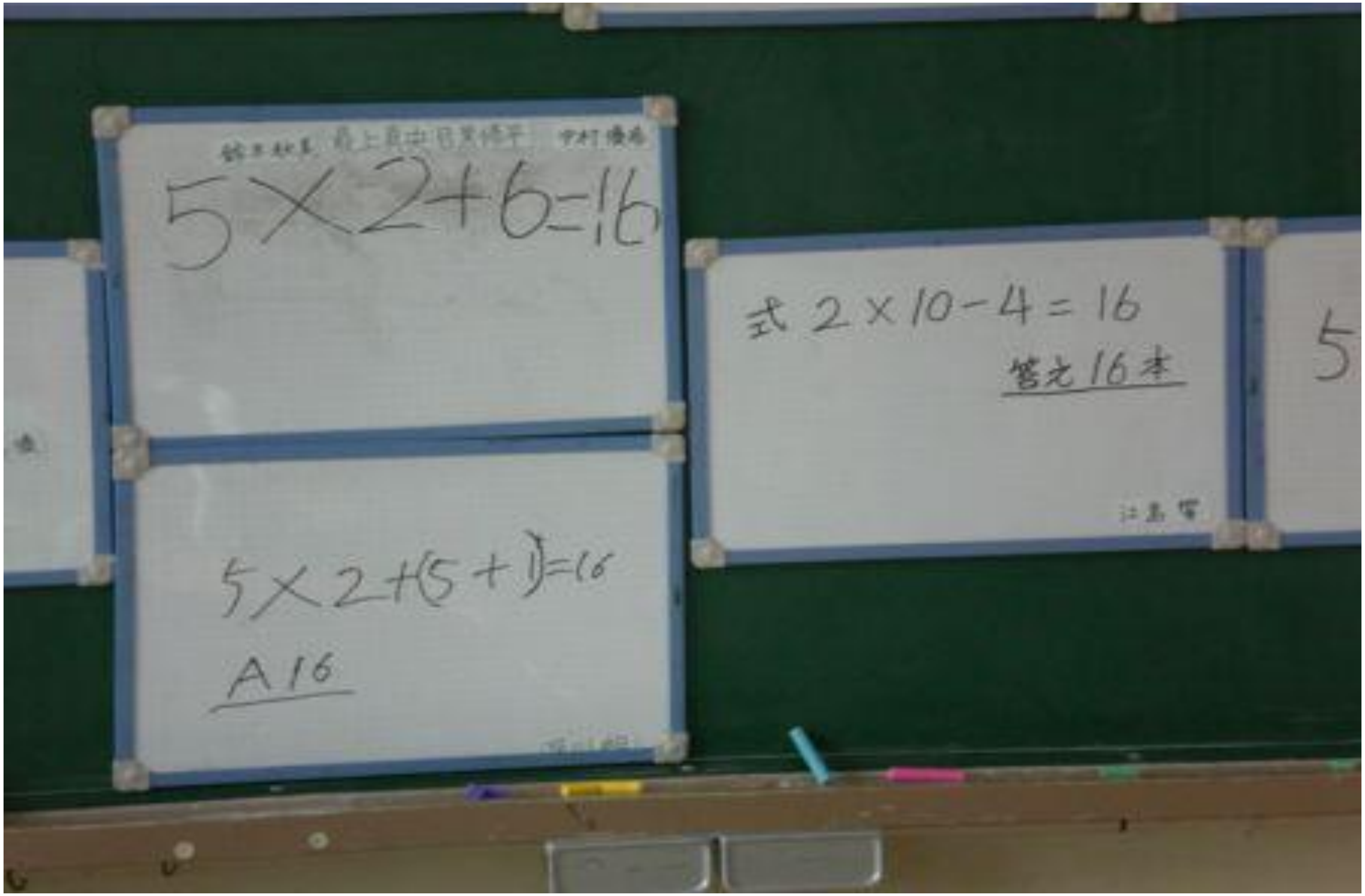

3×5+1=16
羽賀雄海
中村優希


5×2+(5+1)=16
A16


式をよみとりましょう
3×5+1=16
5×3+1=16
答え16本
4×5−4=16
答え16本
8×2=16
A16本


16
5×2+(5+1)=16
正方形の数
正方形の数
A16
森下裕貴
4

Here, two versions of the same rule are being compared. The teacher asks “Which one is easier to follow?”



Why is the teacher highlighting some numbers?

- This was done by the teacher to give emphasis to the idea that each highlighted number is an instance of a general pattern – not a number for calculation.
- She wants the children to see concrete numbers as generalizable numbers.
- This knowledge-in-action is the result of the deep research on teaching materials

Post lesson discussion (university professor, three teachers, department chair, school principal present)

At the post-lesson discussion

- Observers asked teachers about particular points where they had departed from their lesson plan
- Observers asked teachers about specific responses by students
- Teachers brought magnetic boards to refer to and to illustrate particular students’ thinking
- Teachers explained where they thought the lesson had succeeded and where it might be improved next time

Q&A

Thank you!