

How Students Should Learn: Mathematics Problem-Solving Lesson in Japan

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What we are doing: Japanese mathematics Lesson

- Some typical flow or pattern
- Particularly in elementary school and junior high school

Foreign people have noticed the pattern

- **8 Phases**: Jerry P. Becker, Edward A. Silver, Mary Grace Kantoieski, Kenneth J. Travers, and James W. Wilson (1990) James
- **5 Phases**: James W. Stigler & James Hiebert (1999) The Teaching Gap

Organization of Japanese Math Lesson

1. Presenting problem for the day
Understanding the topic **5-10**
2. Problem solving by students
10-20
3. Comparing and discussing (**Neriage**) **10-20**
4. Summing up by teacher (**Matome**) **5**

What we are doing: Japanese mathematics Lesson

- Problem-solving lesson: 問題解決型授業
- To solve a task given is not the aim of problem solving lesson
- Problem-solving lesson means “Teaching through problem solving”
- So, Teaching of what?
- Teaching **contents and process** through problem solving

What we are doing: Japanese mathematics Lesson

- Problem-solving lesson: 問題解決型授業
- Teaching contents and process through problem solving

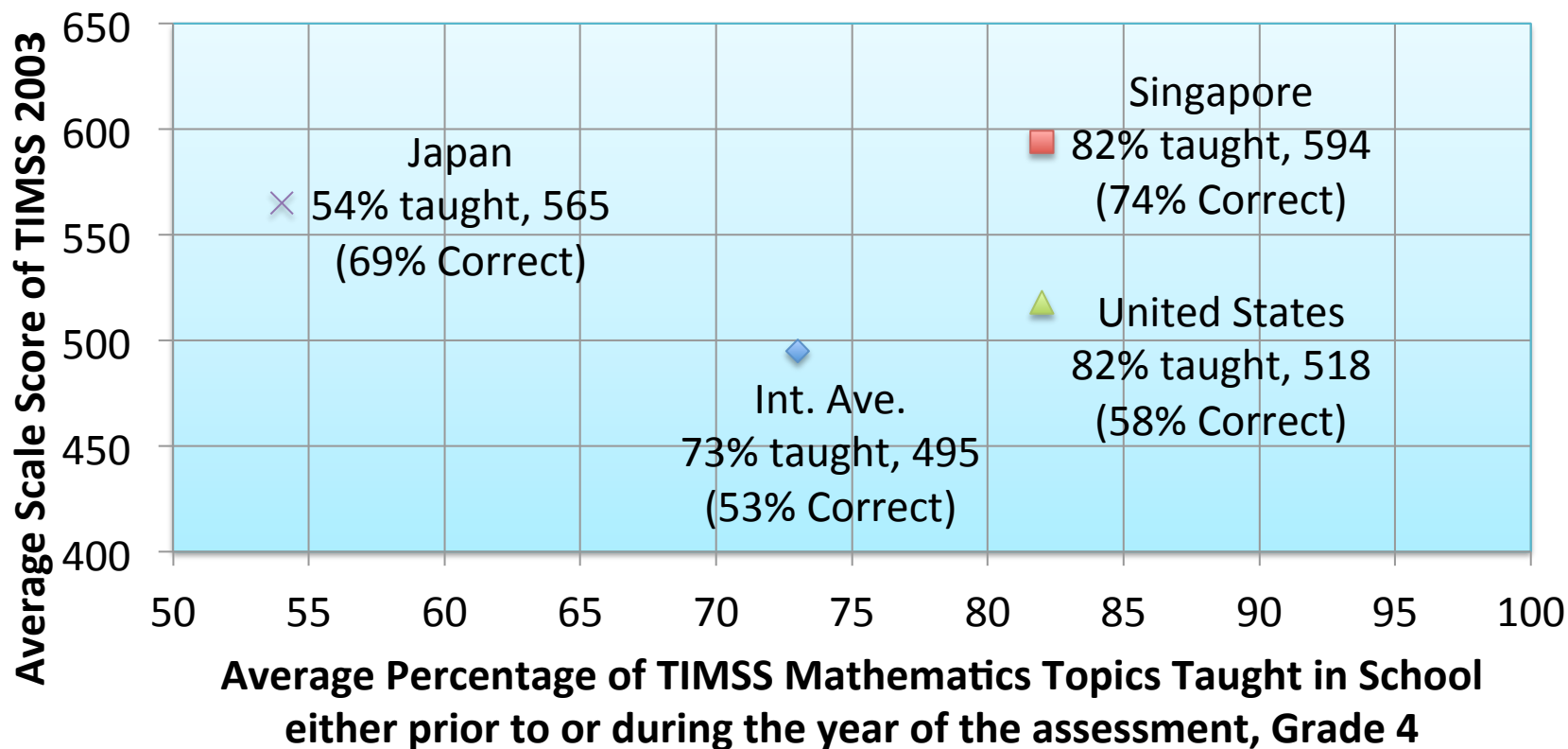
- Elementary school
- Lower secondary school
- Upper secondary school

Organization of Japanese Math Lesson

- “The problem-solving lesson”
- *Japanese teachers always do that?*
- 476 Elementary school teachers (JSME, 2001)
 - Always I do 11.9%
 - Sometimes 47.2%
 - Occasionally 37.1%
- “I think that is a good way of teaching” 41.0%
- “Well, I could say it is a good way of teaching” 56.2%

Average Percentage of TIMSS Mathematics Topics Taught in School and the Achievement (Average Scale Score) of the TIMSS 2003

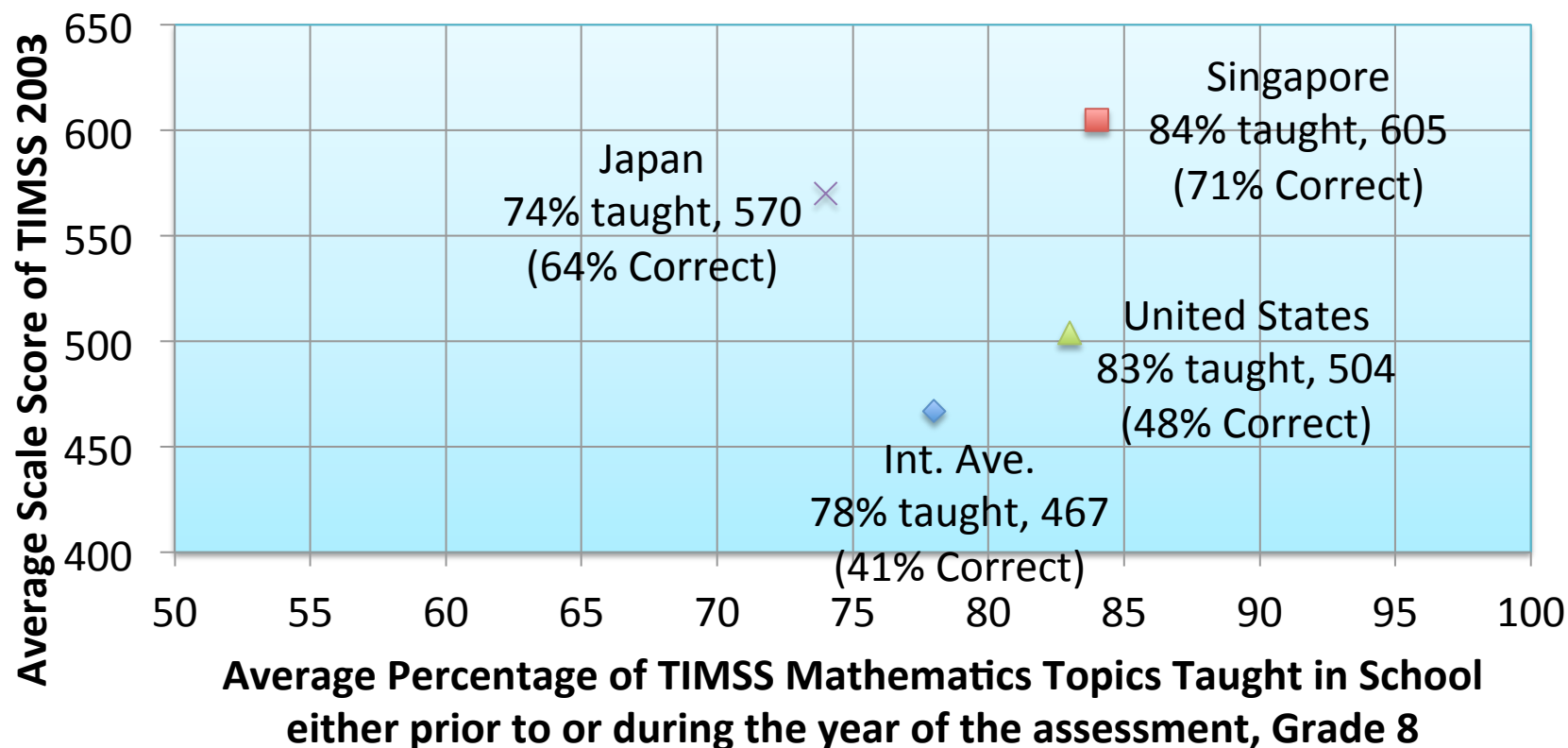
Grade 4



Source TIMSS 2003 International Mathematics Report
Grade 8: Exhibit 5.7 (p.192), Exhibit C. 1 (p.400)
Grade 4: Exhibit 5.7 (p.193), Exhibit C. 1 (p.402)

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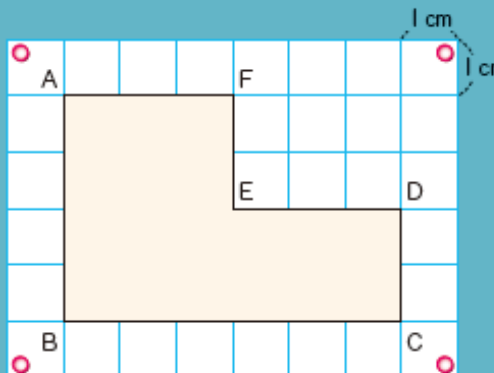
Grade 8



Source TIMSS 2003 International Mathematics Report
Grade 8: Exhibit 5.7 (p.192), Exhibit C. 1 (p.400)
Grade 4: Exhibit 5.7 (p.193), Exhibit C. 1 (p.402)

Methods for finding area

2 Find the area of the shape on the right.



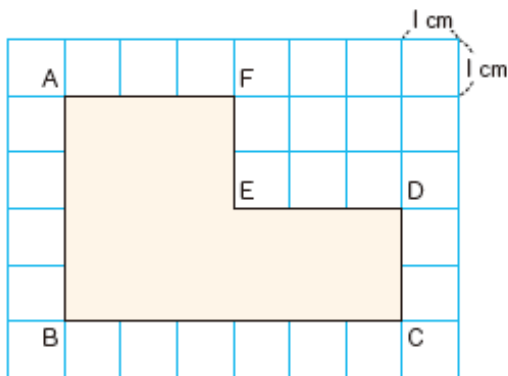
? Let's think about how we can calculate the area of shapes like ?



If the shape is a rectangle or a square, we studied how to calculate its area, so ...

★ Write down the way you thought about doing it using pictures and math sentences.

Use the cards on page 129.



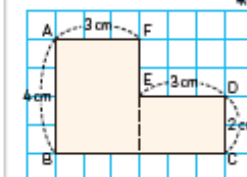
First, think about it by yourself.

Is there anything you have learned so far that you can use?

Write down your ideas.

Write them in a way that other people can understand them.

Kaori



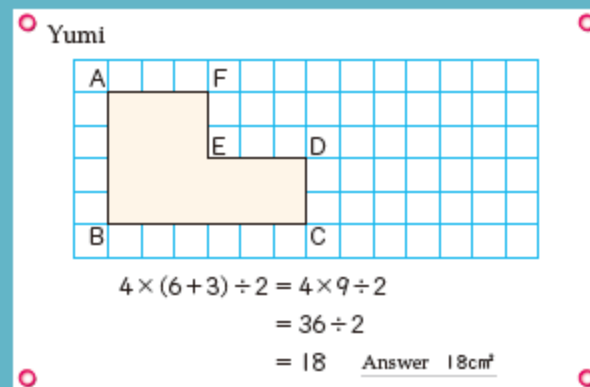
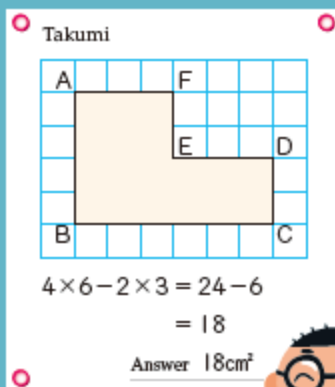
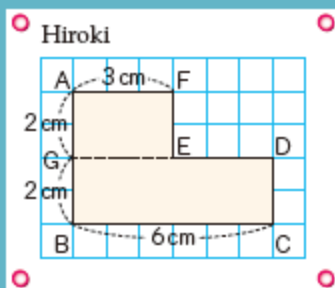
$4 \times 3 + 2$

If you find one way, try to find another way.



It looks like there are many ways, aren't there?

Miho and her classmates are explaining their friends' ideas.



2 Look at what Hiroki drew and write down his ideas using math sentences.

3 Look at the math sentence Takumi wrote and explain how he thought about the problem.

Write down the lengths of the segments and draw in any additional segments in the figure above.

4 Look at the math sentence Yumi wrote on the next page and explain how she thought about the problem.

Write down the lengths of the segments and draw in any additional segments in the figure ...

Find out about your friends' ideas.

Can you understand your friends' ideas?

What are some similarities and differences between these and your ideas?

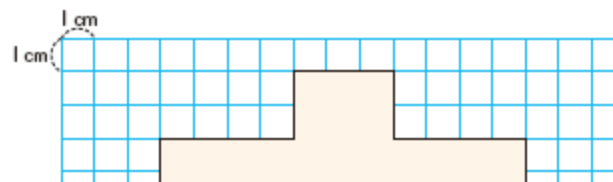
Summary
We can calculate the area of shapes like by making use of rectangles and squares.

We need to use what we have learned so far, don't we?

Let's summarize.

What did you learn in today's lesson?

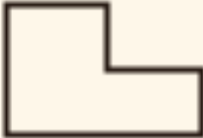
6 Calculate the area of the shape below in many different ways.



Let's check.

Try different problems using what you've learned today.

4) Summing up by teacher

We can calculate the area of shapes like  by making use of rectangles and squares.

We need to use what we have learned so far, don't we?

Summary