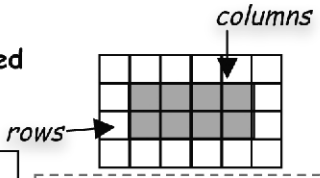
**LESSON LEARNING GOALS**

Identify the curriculum expectations (MOE, 2005) grade-before and grade-after the grade specific learning goal:
- to see the development of mathematical knowledge, skills, and strategies across grade levels
- to determine the mathematical focus of the problems chosen for Before (activation), During (lesson), and After (Practice) parts of the lesson

**BEFORE (Getting Started)**
- 5 to 10 minutes
- Activating students' mathematical knowledge and experience using a prompt or problem that is directly relates to the mathematics in the lesson problem.
- Includes student responses to prompt/problem to highlight key ideas/strategies.

**Tile Problem A:**

**What is the area of the shaded rectangular tiles on the grid?**




**Solution 1**
*I counted 1, 2, 3, …, 6, 7, 8. There are 8 squares in the rectangle*

*Counting by 1s from left to right and top to bottom*

**Solution 2**
*I counted each column … 2, 4, 6, 8*

*Counting by 2s*
*2 + 2 + 2 + 2 = 8*
*2 + 2 + 2 + 2 = 2 x 4*

**Solution 3**
*I counted 4 in row 1 and 4 in row 2 for a total of 8 squares.*

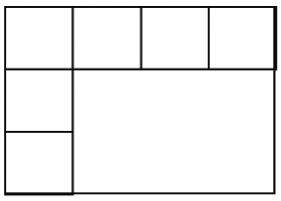
*Making 2 Groups of 4*
*4 + 4 = 8*
*4 + 4 = 4 x 2*

**DURING (Working on It)**
- 15 to 20 minutes
- Understanding the problem – Teacher asks, "What information from the problem are we using to make a plan to solve it? Explain." Teacher records in a list below the problem, the information that students identify.
- Students solve the problem on chart paper (landscape) with markers (visible for whole class discussion) in pairs or in small groups.
- Teacher circulates to record different student solutions, in addition to the ones the teacher anticipated.

**Tile Problem B:**

**Tile the area of this rectangle using equal-sized squares.**

**How many square tiles are needed to cover this space?**



***What information will we use to solve this problem?***
- *Need to cover the big rectangle with the smaller squares*
- *Use the same size squares*
- *Covering means no spaces between the squares*
- *Covering means no overlapping of the squares*

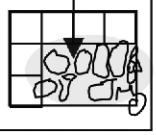
**AFTER (Consolidation)**
- 20 to 25 minutes
- Teacher selects 2 or more solutions for class analysis and discussion in a sequence (1st, 2nd, 3rd, etc.) based on mathematical relationships between the solutions and the lesson learning goal.
- Students (authors) explain and discuss their solutions with their classmates.
- During whole class discussion, solutions are organized (often re-organized) to show mathematical elaboration from one solution to the next and towards lesson learning goal.
- Teacher mathematically annotates (math terms, math symbols, labelled diagrams, concise explanations) on and around solutions to make mathematical ideas, strategies, and models of representation explicit to students.

*What unit of measurement are we trying use to measure the area of a rectangle?*
*- same size, square units*

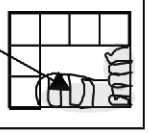
*How do we use the square units to measure area of a rectangle?*
*- using the same size square to cover the rectangle with no overlaps or gaps*

*What part of the rectangle was measured for its area?* → *should cover <u>both</u> the border and the inside*

**Solution 1**
*About 8*



**Solution 2**
*About 17 squares*



***Counting Squares Covering Part of the Rectangle***

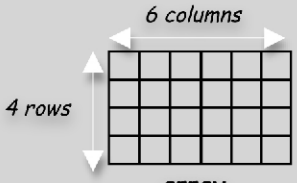
***Counting Small Squares Around Border***

Note: Mathematical annotations include mathematical vocabulary, symbols, elaborations of mathematical details from solutions, labels describing the method/strategy, and questions to further thinking. All annotations are records of students' mathematical discussion.

| Grade 3 | Grade 4 | Grade 5 |
|---|---|---|
| - estimate, measure (using centimetre grid paper, arrays), and record area | - estimate and measure using a variety of tools (e.g., centimetre grid paper, geoboard) and strategies, and record the area of polygons | - determine through investigation using a variety of tools the relationships between the length and width of a rectangle and its area and generalize to develop formulas (i.e., Area=length x width) |

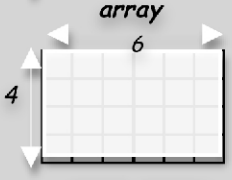
***Area***

*total number of same size squares (or square units) that completely cover a shape (e.g., rectangle) with no spaces or overlapping*




*array*

*Area (rectangle)*
*= number of rows x columns*
*= 4 rows x 6 columns*
*= 24 square units*




***open array***

**AFTER (Highlights/Summary)**

- 5 minutes
- Teacher and students revisit the student solutions for key ideas, strategies, and models of representation that are related to the lesson learning goal.
- Teacher lists key ideas, strategies, and models of representation separately, so the students can see how the mathematical details from their solutions relate explicitly to the lesson learning goal.

**Highlights/Summary:**

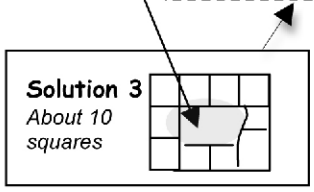
*- Tile an area by using the same size shapes, like squares:*
*- repeating (iterating) the square unit end to end, horizontally and vertically*
*- with no spaces or overlaps between square units*
*- To measure area of rectangles -> arrange the squares in rows and columns or an array*

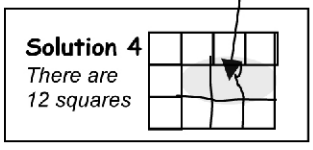
**AFTER (Practice)**

- 5 to 10 minutes
- Teacher chooses 2 or 3 problems, similar to the lesson problem for student to solve in pairs as a scaffold and individually.
- Problems could vary by number (choice, size), problem contexts, or what is unknown or needs to be solved
- Students are asked to solve these problems using a strategy different from the one they used for the lesson problem.

*How is the area of the middle part of the rectangle being measured?*

*Extend lines to draw from the squares on the top and side to make array*



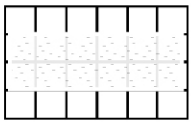




***Same Size Square Units Iterated Around Border***

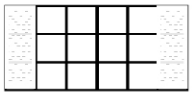
***Same Size Square Units Iterated as Rows and Columns***

**Tablecloth Problem:**

**A table cloth that is 2 square units x 4 square units will cover a table top exactly. Will these cover it? How do you know?**



tablecloth A



tablecloth B

**Solution 1**

*-Table top is 2x4=8 square units or 2 rows x 4 columns*
*-Tablecloth A – 2 hidden rows by pattern so it is 4 (2+2) rows x 6 columns*
*-Tablecloth B – 2 column of 3 rows is hidden by pattern, so 3 rows x 6 (1+4+1) columns*
*- 2x4 < 4 x 6 ->so A covers it*
*- 2x4 < 3 x 6 ->so B covers it*

**Solution 2**

*B – 3 rows x 1 column hidden by pattern, so 3 rows x 6 (1+4+1) columns which is larger than 2 rows x 4 columns*

*Tablecloth B is smaller than A, so tablecloth A must cover it if B covers the table top.*

Note: A classroom board is longer proportionally than these 2 pages. Due to the space constraints on these pages, the mathematical annotations are recorded above the solutions with arrows, rather than on and around the solutions.