

IMPROVING TEACHER QUALITY PROGRAM
Mathematics Within: Algebraic Processes and Its Connections to Geometry

Participant Name: Susan Gallagher, Rebecca Lindgren, Caroline Thompson

Broad Topic: Number Theory

Subtopics: Arrays and Factors

Grade Level: 5

Time Frame: 30 minutes

Aim: Understanding multiplication in terms of arrays and factors

Specific Objective(s):

- Students will make arrays for multiples of numbers 2 through 10 and identify the number of rows and columns as the factors of the number.
- Students will identify patterns of factors as they enter them on a hundred grid

Materials/Supplies:

- 100 cm³ blocks and cm graph paper—(attachment, page 4-6).
- “Sieve of Eratosthenes” class handout
- *Everyday Mathematics*, Grade 5, Unit 1

Special Notes:

Vocabulary: row, column, rectangular array, number model, methodical, odd, even, prime, composite, factor, multiple

Context: Use with *Everyday Math* Unit 1
1.2 Rectangular Arrays
1.3 Factors
1.4 Factor Captor Game
1.5 Divisibility
1.6 Prime and Composite
1.7 Square Numbers
1.8 Unsquaring Numbers
1.9 Factor Strings, Prime Factorization

Background: In lesson 1.2 rectangular arrays, rows, column and multiplication numbers models are reviewed.

Lesson:

• **Introduction**

Review terms and practice making and counting arrays, and identify the patterns of factors in a hundreds grid—(pp.4-6).

• **Body**

1. What numbers can be made with 10 or fewer blocks and can be represented as an array with 2 rows?

2. How many possibilities are there?
Review odd and even.
Count the blocks by 2s
Which numbers are skipped when we make arrays with 2 rows?
How can the arrays be arranged so we know that we haven't missed any?
'Methodical' means there is a plan or a certain order to making the arrays.
What's our plan?
3. Chart 2-row arrays on the number chart.
Any number that can only be represented as a 1-row array (prime) will not be put in the grid, because those numbers represent a special case (prime).
4. Homework—send home cm grid paper and tell them to chart the arrays for 3.
5. Finish the chart with all the arrays to 10. Make Venn Diagrams with pairs of factors.
6. Use classroom chart for reference, review, and closure.

- **Close**

Practice making and evaluating arrays to better understand multiplication and identify the patterns of factors from 1-100.

Special Note-- For Enrichment:

Use the chart (pp. 4-6) to check the theorem: If a is prime and a divisor of bc , then a is a divisor of b or c or both.

Children's Literature: Mitsumasa Anno's "Multiplying Jar;" (multiplication) or "Magic Seed" (Counting) .

- **Application/assessment**

1. Monitor formation of arrays as students construct them, learning logs, attending to class discussions, formal assessment at end of unit.
2. Area model of multiplication, identify primes, prime factorization, fractions - common denominators.

The Lesson In Greater Detail:

I. Making arrays for multiples of 2:

Show the number 2 as an array of 2 unit cubes; arrange the array as 2 rows and 1 column. Review vocabulary words on word wall (row, column). What other arrays having only 2 rows can be made using 10 cubes or fewer? Make these arrays on a 1 cm grid paper map; outline each different array so that you can keep track of the different ones made. Look at each array traced on grid paper. Remember the area model for multiplication. Label the arrays, giving the number of rows first, times the number of columns. Demonstrate example 2×3 , saying 2 rows times 3 columns. How many cubes are in this array? Turn it into the number sentence $2 \times 3 = 6$.

II. Odd and Even

How can we know that we have made all the possible arrays between 2 and 10? Start with the array for 2; add one cube; what is the total number of cubes? Start a chart with the #2 arrays in one column and the other number totals in a second column. Have we missed any numbers between 2 and 10? What pattern do you see? (Even and odd numbers, every other one, etc.) How did the arrays for the numbers in the second column look different from the arrays of numbers in the first column? (Always one cube alone, not a pair, without a partner + the odd one)?

We are not going to include any numbers that are themselves times one in our grid at this time. Do not include 2×1 - it is a special number (prime).

III. Entering Factors on 100 number grid:

Look at the 100 number grid. We are going to enter our arrays for 2 on it by the total number of cubes used in an array. So 2×3 would be entered in the box labeled 6 and 2×4 would be written in the box for 8. The array of 2 rows and 3 columns models the multiplication of the factors 2 and 3 and we write that multiplication as 2×3 . (# New word wall word—factor.) Enter the multiplication sentences for all the arrays you have found using 2 rows, on the 100 grid. Be methodical—have a plan so that you get them all. Look at your chart—highlight all the $2 \times$ places on your chart. All the box numbers with these highlighted arrays in them are called multiples of two because one of their factors is 2 (# word wall—multiple).

Class discussion: In your learning log describe the patterns you see on the grid for multiples of two.

IV. Homework -send grid paper home

Draw and name/label block arrays for multiples of 3. Be methodical—have a plan and check multiples at morning work time.

V. Continue making and entering multiples of 3 and 4.

After entering multiples of 3, make a Venn Diagram showing the overlap areas of multiples of 2 and 3 in the learning log. After multiples of 4 are entered on the 100 grid, make a diagram showing that multiples of 4 are entirely contained in the circle for multiples of 2. Continue making arrays for multiples of 5, 6, 7, 8, 9, and 10 on the 100 grid. Enter and color code each set of multiples. Make Venn Diagrams for 5 and 10; 1, 4, and 8; 3, 6 and 9. For the final learning log entry—describe patterns and relationships

VI. Classroom wall chart of 100 grid with area model for reference, review and closure.

VII. Enrichment

Use the chart to check the theorem: If a is prime and a divisor of bc , then a is a divisor of b or c or both. Our grid used multiples of 2 through 10.

Check the theorem with primes between 2 and 10 [2,3,5,7]. Then try multiples of 4, 6, and 8, which are not prime. Why doesn't this work for numbers that are not prime? *refer to this theorem later in the year when working with fractions and least common denominators.

*Introduce a theorem—something that can be proved and then used as a tool in logical reasoning.

Literature link - Mitsumasa Anno's "Multiplying Jar;" (multiplication) or "Magic Seed" (Counting) .

VIII. Assessment/Application

1. Assessment

- monitor formation of arrays as students construct them
- learning logs
- attending to class discussions
- formal assessment at end of unit

2. Application

- area model of multiplication
- identify prime
- prime factorization
- fractions - common denominators

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50

51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100