

Array Problem – Filling Bookshelves

Overview

This investigation is given to students **before** the introduction of the standard multiplication algorithm. Students have had experiences in multiplying one-digit numbers and in multiplying by multiples of 10. In this investigation students are encouraged to represent their thinking using an array, which will help them recognize the groups of objects that make the whole. This recognition will facilitate the development of strategies such as skip counting, repeated addition, doubling, and using the distributive property.

Learning Objectives

This investigation will help students to:

- model multiplication situations using an array
- consider multiplication as a whole consisting of a number of groups containing the same number of items
- develop multiplication strategies such as skip counting, repeated addition, doubling, and using the distributive property

Learning Expectations

Students will:

- multiply two-digit whole numbers by one-digit whole numbers using a variety of tools, student-generated algorithms, and standard algorithms

Materials

- interlocking cubes, two-colour counters, colour tiles
- chart paper, markers

Getting Started

- Present the following situation to the class:

I have a problem I hope you can help me with. I'm reorganizing our classroom and I was trying to figure out how many math books would fit on this bookshelf (I point to a bookshelf with 6 shelves, the top shelf of which is filled with 14 math books).

Mr Johnson would like to store some of his math books in our room as well because he doesn't have enough space in his own classroom, so I need to know the total number of books this bookshelf will hold to see if we have enough space. Can you help me find out how many books will fit on this bookshelf?

- Ask the following questions to help students understand the problem:
 - What do we need to find out?
 - What information is important to know?
 - What tools can we use to help solve the problem?

- Clarify the task and the expectations for students' work:
 - Instruct students to work in pairs or small groups.
 - Tell students they can use manipulatives or paper and pencil to find their solution.
 - Explain that all groups must choose a strategy that makes sense to them, because they will be sharing their solutions on the chart paper provided so everyone can see the strategy they used to solve the problem.

Working on It

Once students have started working, take on the role of facilitator and circulate among the groups to:

- Observe how well students are able to represent the situation and their strategies using manipulatives or chart paper.
- Probe and guide students' thinking by asking questions such as:
 - How can you show your thinking on your chart paper?
 - Where are the books represented in your solution?
 - Is there another way you can answer this question?

Note: Some students may try to use the standard multiplication algorithm if they know it. Remind these students that they will need to explain their strategy and what is happening to the books and shelves when they use this algorithm. Alternatively, suggest that they try to solve the problem using a different strategy and then connect the algorithm with the new strategy.

- Select a number of groups (3 or 4) to present their solutions during the **Reflecting and Connecting** portion of the lesson. Selections should reflect a variety of strategies with varying efficiency and should encourage building connections.

Reflecting and Connecting

Gather the whole class together, then:

- Invite groups up to the front to present and discuss the strategies they used to solve the problem.
- Discuss and compare the various strategies that students used to arrive at the same answer. Emphasize that different methods are possible and that all of them can be “seen” using an array.