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Understanding Division As It Relates To Multiplication

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Introduction

When developing an understanding of whole number concepts involving multiplication and division, it is important to move from concrete to pictorial to symbolic activities for students in the elementary grades. In the Fall 2001 issue of the Alabama Journal of Mathematics (pp. 50-52), four ways to help students understand the meaning of multiplication through the use of concrete manipulatives were presented – using graph paper (making arrays), using counters (making equal sets), using coins (skip counting), and using related facts (fact families). These activities begin the process of relating multiplication to division.

The National Council of Teachers of Mathematics in its document, Principles and Standards for School Mathematics (NCTM, 2000), identifies the need for all students to "understand meanings of operations and how they relate to one another" (p. 78). In addition, this document states that students should "begin to develop an understanding of the concepts of multiplication and division" (p. 84) "such as equal grouping of objects and equal sharing" (p. 78). Students can then investigate division with real objects and through story problems. The strategies used to solve such problems-the repeated joining of, and partitioning into, equal

subgroups-thus become closely associated with the meaning of multiplication and division, respectively.

The *Alabama Course of Study: Mathematics* (Alabama State Department of Education, 1997) states that elementary school students need to "investigate the concept of division" (p. 23) and "develop an understanding of division" (p. 29). The following activities are designed to help students develop an understanding of division concepts related to their knowledge of multiplication.

Illustrating Division as Measurement or Repeated Subtraction

Materials: circular counters
small paper plates
chalk
chalkboard

Procedure:

(1) Form groups of 2 students each.
(2) Give each pair/group of students 30 circular counters.
(3) Ask each group to see how many equal-sized groups of 6 counters can be removed from the total of 30 counters.
(4) Begin by removing the first group of 6 counters and placing the counters on a small paper plate.
(5) Continue removing groups of 6 counters and placing each new group of counters on another small paper plate. Continue until all counters are gone.
(6) Show the problem on the board as a subtraction problem.

$$\begin{array}{rl} 30 & \\ -6 & \text{(1 group)} \\ \hline 24 & \\ -6 & \text{(1 group)} \\ \hline 18 & \\ -6 & \text{(1 group)} \\ \hline 12 & \\ -6 & \text{(1 group)} \\ \hline 6 & \\ -6 & \text{(1 group)} \\ \hline 0 & \end{array}$$

(7) Point out that 5 groups of 6 counters (equal-sized groups) were removed from the total of 30 counters.

$$\underbrace{30}_{\text{total number of counters}} \div \underbrace{6}_{\text{counters in each group}} = \underbrace{5}_{\text{equal-sized groups of 6 counters each}}$$

(8) Explain that you know the total and how many are in each group, but you are trying to find the number of equal-sized groups (i.e., measurement division or repeated subtraction).

(9) Have students try the following for more practice.
- equal-sized groups of 5 using the total of 30 counters
- equal-sized groups of 15 using the total of 30 counters
- equal-sized groups of 2 using the total of 30 counters

(10) Write the subtraction problems on the board for the above examples. Relate these problems to the concept of division.

Illustrating Division as Distributive or Sharing Situations

Materials: links or unifix cubes
small paper plates
chalk
chalkboard

Procedure:

(1) Form groups of 2 students each

(2) Give each pair/group of students 20 links or unifix cubes.

(3) Ask each group to separate the 20 links into 5 equal-sized groups. Begin by setting out 5 paper plates. Then, place 1 link on each paper plate.

(4) Continue until all links have been evenly distributed onto the 5 paper plates. This process should be similar to the following:

Place 1 link on plate #1, 1 link on plate #2, 1 link on plate #3, 1 link on plate #4, 1 link on plate #5; then, another link on plate #1, another link on plate #2, and so on, until all links are distributed.

(5) Develop the idea of distributing one link equally among the groups, going through the process again and again until all links are gone.

(6) Explain that this is a situation in which a total is separated into a given number of equal-sized groups and the students find the number in each group.

$$\underbrace{20}_{\text{total number of links}} \div \underbrace{5}_{\text{number of equal-sized groups}} = \underbrace{4}_{\text{number in each group}}$$

(7) Have students determine the number of groups using 20 links or unifix cubes with the following:
- 4 groups
- 10 groups
- 2 groups

(8) Write the division facts on the board for the above examples. Practice by using other totals (number of links or unifix cubes), for example: 10, 15, or 25.

Illustrating Division as the Inverse of Multiplication

Materials: small chalkboards
chalk for each group

Procedure:

(1) Form groups of 2 students each.
(2) Ask one student in each group to write the following three related numbers on the chalkboard: 4, 7, 28.
(3) Give students a multiplication fact/problem such as $4 \times 7 = 28$. Ask them to write this fact on the chalkboard, then identify another multiplication fact/problem that can be formed using the same three numbers: $7 \times 4 = 28$. Write it on the chalkboard.
(4) Ask students to identify the two related division facts/problems using the same three numbers: $28 \div 4 = 7$, and $28 \div 7 = 4$. Write these on the chalkboard.
(5) Develop the concept that division is related to multiplication or the inverse of multiplication.
(6) Using the following three numbers (4, 7, and 28), show four related facts — 2 multiplication and 2 division. If they have not been erased, they could already be on the chalkboard.

$$4 \times 7 = 28 \qquad 28 \div 4 = 7$$
$$7 \times 4 = 28 \qquad 28 \div 7 = 4$$

(7) Practice the concept by providing students with several sets of three related numbers. Ask the students to show on the chalkboard the four related facts for each set of three numbers.

References

(1) Alabama State Department of Education (1997). *Alabama Course of Study: Mathematics,* Montgomery, AL.
(2) Daane, C. J., and Lowry, P. K. "Understanding Multiplication." *Alabama Journal of Mathematics,* 25(2), 50-52.
(3) National Council of Teachers of Mathematics (2000). Principles and Standards for School Mathematics, Reston, VA.