

Instructional Directions

I. Pre-Assessment

The class period before doing the lesson or as an email pre-assignment, ask the students to write a journal entry for the prompt: “What do you know about the concept of ratio?”.

II. Cube Activity

Arrange the students in small groups containing 2-4 students in each group. Give each group a single copy of Table 7 and a single copy of Table 8 along with a sandwich bag of rainbow cubes. Instruct the students to fill out the tables with cubes according to the instructions provided. In their notes they should draw the corresponding “number” tables. When they finish working with the cubes, they should look for addition and multiplication patterns in the “number” tables in their notes.

III. Teacher-Led Discussion

Use transparencies of Table 7 and Table 8 together with either overhead “rainbow” centimeter cubes or colored transparency markers to briefly discuss what the students did to fill out the tables. This should be done by soliciting ideas from the students in order to bring out the variety of problem-solving ideas used by the class. Then construct corresponding number tables and solicit structural patterns from the class. It is important to bring out several ideas:

1. Only in Table 7 may the numbers in one row be multiplied or divided by a constant in order to find the numbers in the other row.
2. There is a connection between repeated addition and multiplication. It is the number in the first box that is being repeatedly added. Therefore subsequent numbers are multiples of this first number.
3. Numbers “early” in the tables may be found using repeated addition. However, the idea of “multiple” is needed to find numbers “far out” in the tables.
4. There is a “cross multiplication” pattern in the tables that may also be used to find numbers “far out” in the tables.

An example of “cross multiplication” is as follows. When the entry in row 1, column 1 is multiplied by the entry in row 2, column 3, the product is the same as the product when one multiplies the entry in row 2, column 1 by the entry in row 1, column 3.

IV. Small Group Problem Solving

Extend the activity to the “abstract” level. In Table 8 place “n” in an unknown position in row 1. Ask the students to determine an algebraic expression that would describe the number of green cubes in that column. Provide overhead sheets and markers for the groups to write down their work and explain how they arrived at their answer. As you “move about the room,” work with struggling groups by suggesting that they examine the mental process they would use to

determine the number of green cubes in a column if the number of blue cubes is already provided. If they can not yet in any way articulate that process, suggest that they work with concrete numbers first in order to determine the underlying process. Also suggest that they use words such as ‘blue cubes’ and ‘green cubes’ to write down the process before they extend the idea to the use of the variable n .

V. Teacher-Led Discussion

Pick a couple of group overhead sheets to present to the class. Particularly try to use ones that start concrete with numbers and move to a verbal representation prior to the abstract representation involving a variable. If none of the groups started concrete or used a verbal representation, introduce it yourself. Explain that you are illustrating the mental process that many of their future students will need to work through in order to grasp the abstract representation.

VI. Small Group Problem Solving

Distribute the worksheet of application problems to the students. Instruct them that they must use tables to solve the problems.

VII. Teacher-Led Discussion

As a class, discuss any of the problems that seemed to cause the students some trouble. In particular, discuss #4. It is helpful to introduce a third “total” row to the table and recognize that it is proportional with the first two rows. Also discuss that “labeling” rows is a helpful practice.

VIII. Post-Assessment

Ask the students to write an in-class or email journal entry in which they respond to the prompt: “What new things about ratio did you learn from the activities we have been doing?”.

Beyond this Lesson:

Supplemental problems that may be solved using tables are available to use as a homework assignment. At this point instruction can move to formal definitions and notation for ratio and proportion. The “cross-multiplication” pattern in the tables may be used to motivate the definition for the equality of ratios.