MISSISSIPPI DEPARTMENT OF EDUCATION

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Mississippi Mathematics Manipulatives Manual

Featured Activity

"Exploring Volume"

5.MD.4

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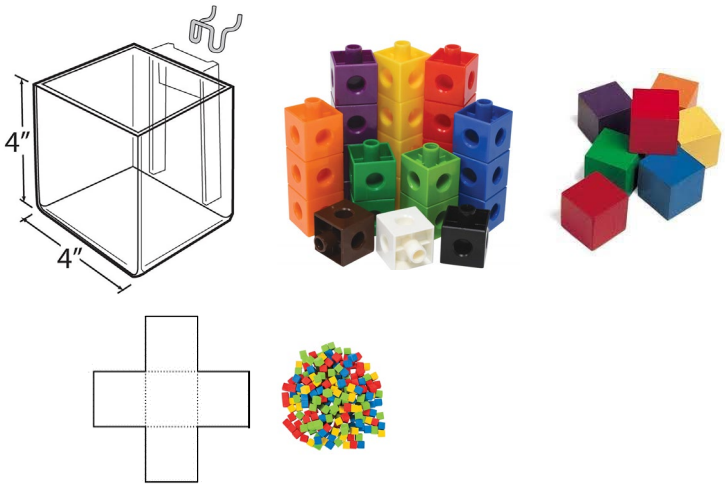
As we continue our efforts to develop high-quality instructional materials (HQIM) and resources, the Mississippi Department of Education (MDE), through the Academic Education Office, would like to showcase instructional practices and activities that foster conceptual understanding through the use of manipulatives in the mathematics classroom.

The **Mississippi Mathematics Manipulatives Manual** features activities meant to serve as short, hands-on procedures that may be implemented before, during, or after a lesson to support the teaching and learning process of the Mississippi College- and Career-Readiness Standards (MCCRS) for Mathematics. Alignment with the MCCRS Scaffolding Document has been included for additional support. Teachers may contact staff at the MDE if they would like to borrow manipulatives for classroom use.

Teachers may modify these activities to meet the needs of the students they serve and their instructional delivery model (virtual, in-person, or hybrid).

Special Thanks:
Celeste M. Maugh, M.Ed.,
Tunica County School District

Exploring Volume



MANIPULATIVE(S):

- Colored Linking Cubes or 1-inch wooden cubes, 25
- Acrylic 5-Sided 4”x4”x4” Cube

Alternative Manipulatives:

- Cube net
- 1-centimeter wooden cubes

GRADE LEVEL OR COURSE TITLE:

CCR Mathematics Grade 5

DOMAIN AND CLUSTER HEADING:

Measurement and Data (MD):

Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition

STANDARD(S):

5.MD.4: Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units.

PREREQUISITE SKILLS:

- Know the names and attributes of two-dimensional shapes, especially squares and rectangles.
- Know the names and attributes of three-dimensional shapes, especially rectangular prisms, and cubes.
- Know two-dimensional figures can be measured using area.
- Know how to find the area of a figure using square units or the standard algorithm.
- Know how the formulas for the area of rectangles and squares are derived.

ACTIVITY:

Note: Activity Sheet Attached

1. In a whole group, review with students the term dimension and how it relates to two- and three-dimensional shapes; how to find the area of a two-dimensional shape, the definition of volume, and the fundamental difference between area and volume.
2. Partner students or place them in small groups.
3. Distribute an acrylic cube and linking cubes to each pair or group of students.
4. Have students discuss the attributes of the acrylic cube and determine whether it is a two- or three-dimensional shape. Then, have students justify their answer by naming the dimensions: length, width, and height.
5. Discuss with students the relationship between having three dimensions and using cubic units. Have students compare cubic units to the squared units used with two dimensions when calculating area.
6. Ask students to use the linking cubes to fill the base of the acrylic cube with no spaces. If possible, encourage students to use one color of linking cubes for the base layer.
7. Ask students to calculate the area of the base and what dimensions were used for them to arrive at their answer. Guide students to the realization that the Area of the base (B) is equal to the length multiplied by width or $B = l \times w$.
8. Next, have students to use the linking cubes to fill the acrylic cube with no spaces. If possible, encourage students to use a different color of linking cubes for each layer.

Figure 1: Model of Acrylic Cube filled with linking cubes. Each layer is represented by a different color.

9. After students have filled their cube, have them to calculate how many linking cubes they have used in all, and display their method of calculation on the board.
10. Guide students to the realization that the volume of the cube (V) is equal to the area of the base (B) multiplied by the number of layers or the height (h). $V = B \times h$ or $V = l \times w \times h$. ***Note:*** Students are not required to use the actual formulas until standard 5. MD.5.

QUESTIONS TO CONSIDER:

- How many layers of cubes does it take to fill the prism?
- How many cubes are in each layer?
- Is there a way to use the number of cubes in each layer to calculate the total number of cubes in the prism?

RESOURCES:

- Mississippi Mathematics Scaffolding Document (Grade 5, Page 51-52)
- 2016 MCCRS for Mathematics
- Virtual Unifix Cubes- Didax.com
- Virtual Cubes- Toytheater.com

Optional: The University of Mississippi's Center for Mathematics and Science Education has an extensive inventory of math (and science and technology) tools and manipulatives that teachers may borrow for classroom use at no charge. Click the link below to access the inventory list and complete a check-out request.

- CMSE Manipulatives

BEYOND THE ACTIVITY:

- **Extension(s)**: By changing the shape of the acrylic cube to other prisms, this activity can be used to help students derive a formula to calculate the volume.
- **Misconception(s):** Students may believe that cubic units will only measure cubes, and that squared units will only measure squares.

Activity Sheet: Cube Net

Directions: Cut out along the bold exterior edges. Fold sides along the dotted line. Tape edges together to create a 5-faced cube, leaving the top open.