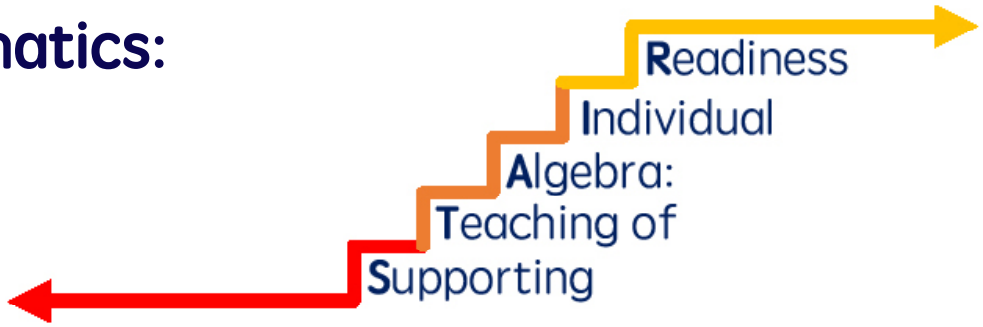
Ideas in Mathematics:
Volume



Key Concepts of Volume

- Liquid volume or capacity refers to the amount that a container will hold.
- Volume can refer to the capacity of an object as well as the amount of space occupied by the three-dimensional object.
- Surface area does not dictate volume, instead prisms and shapes with more cube-like dimensions have greater capacity than objects with the same surface area that are long and narrow.
- Students may struggle with identifying and using the height of an object to calculate the volume. Explicitly teach how to identify the height of an object.

Teaching Volume

- Younger students can sort objects to determine which objects "hold more" or have greater capacity. This can also be done by filling objects with beans, rice, water, or popcorn to determine the capacity of the objects.
- For older students, you can provide them with inch cubes or blocks and ask them to create prisms of various dimensions and ask them to calculate the surface area and volume for each prism.
- In addition, you can provide students with empty boxes and ask them to determine the volume, as demonstrated in Activity 18.29. It may be beneficial to have students note the number cubes that fit in the bottom of the box.

Activity 18.29 CCSS-M: 5.MD.C.3, 5.MD.C.4, 5.MD.C.5; 6.G.A.2; 7.G.B.6

Box Comparison: Cubic Units

Provide students with a pair of small boxes that you have made from card stock (see Figure 18.20). Use unit dimensions that match the cubes that you have for units. Students are given two boxes, one cube, and a corresponding ruler (If you use 2-centimeter cubes, make a ruler with 2-centimeter units). Ask students to decide which box has the greater volume or if they have the same volume.

Here are some suggested box dimensions ($L \times W \times H$):

$6 \times 3 \times 4$ $5 \times 4 \times 4$ $3 \times 9 \times 3$ $6 \times 6 \times 2$ $5 \times 5 \times 3$

Students should use words, drawings, and numbers to explain their conclusions. Repeat with boxes with fractional values. For example, ask students to estimate and then determine which of the following shipping boxes has the greatest and least volume:

$\frac{1}{4}$ ft $\times$ 3 ft $\times$ $2\frac{1}{2}$ ft $\quad$ 4 ft $\times$ $\frac{3}{4}$ ft $\times$ $\frac{1}{2}$ ft $\quad$ $\frac{5}{12}$ ft $\times$ 2 ft $\times$ $\frac{3}{4}$ ft $\quad$ 2 ft $\times$ $\frac{1}{4}$ ft $\times$ 3 ft

(Van de Walle et al., 2019)

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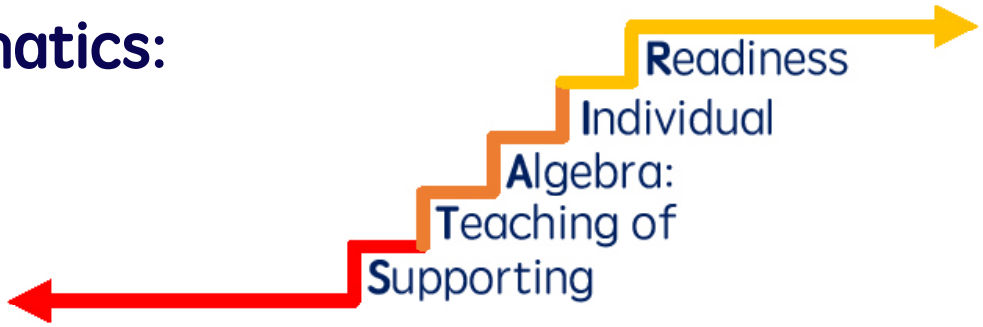

- Once students are comfortable understanding the concept of volume, develop formulas for finding volume with students. Begin with regular prisms, and then move to cones, pyramids, and spheres. Utilize translucent plastic models and emphasize that a reoccurring theme in calculating volume is to find the base times the height.

Resources for Teaching Volume

- **Toy Theater Cube Activities**
  In this space, students can practice building digital three-dimension shapes with cubes.
- **NCTM Geometric Solids**
  This space allows students to explore digital three-dimensional objects.