What is Volume?

Objective:
Students will be to find the volume of a right rectangular prism.

Overview:
In this lesson, students will be faced with several real-life and mathematical situations for which volume can be found. This lesson includes hands-on demonstrations (i.e. "packing" a right rectangular prism with cubic centimeters or inches) and work with mathematical models.

Key Content Standard(s):

5.MD.C.5.

Key Practice Standard(s):

7

Lesson Plan:

1. Prior to this lesson gather as many real-world right rectangular prisms that you can find. Examples could include shoeboxes, video game cases, cereal boxes, bricks, tissue boxes, and/or Rubik's Cubes. Strive to have at least one that has an opening (i.e. a shoebox and a brick are great, but two bricks are not ideal). If at all possible, collect blocks that are either 1 cubic inch or 1 cubic centimeter (cubic inches are easier for the lesson that follows). Check with your math specialist or early education teachers if you do not have any.
2. Begin by reviewing the definitions of perimeter and area. Also review the units one uses to measure area (i.e. square units), and why we call them “square units”. Tell students that these both describe 2-dimensional objects. Ask students how can we describe the measurements of a 3-dimensional shape (for this purpose, I will use a shoebox). Students will likely volunteer length and height, and may volunteer width and/or volume. Tell them that just like we have area and perimeter to describe aspects of 2-D objects, we can describe the volume of a 3-D object.
3. Tell students that volume is the amount of a space a 3-D object takes up, and that just as we describe area in terms of square units, we describe volume in terms of cubic units. Display the cubic inch or centimeter, if you have one. Measure the cubes dimensions to underscore why it is called a cubic inch or centimeter.
4. Ask students how we find the area of a square or rectangle (answer: length x height). Ask students if they can make an educated guess about how we find the volume of a rectangular prism, such as a shoe box (answer: length x width x height). Tell students that objects that we can hold have these three qualities; this is what we mean when we say “three dimensional.” Tell students that what you call length, width, or height doesn’t really matter; demonstrate by rotating the rectangular prism.
5. Use a ruler to measure the dimensions of a rectangular prism (in the model lesson, an empty of plastic sandwich bags was used). Round measurements down to the nearest inch (or

centimeter, if using cubic centimeters). Have students calculate the volume (e.g. 60 cubic inches).

6. Ask students to predict what will happen if you begin packing cubic units into the rectangular prism. Students should respond that you will be able to pack the number of cubic units you found for the volume. Demonstrate that this is the case.
7. You may want to repeat this with one or more additional rectangular prisms.
8. Ask students to identify real-world situations where the volume or rectangular prisms must be known. Some examples could include swimming pools, aquariums, packaging, and shipping. With the students, create reasonable scenarios.

Assessment:

1. Have students answer the following question: An Olympic-size swimming pool is 50m long, 25m wide, and recommended 3m deep. What is its volume?

Differentiation:

When introducing volume, using whole numbers as dimensions makes a great deal of sense, especially when demonstrating with actual cubes. However, it is also a good idea to use measurements in decimals, both because the real-world includes many non-whole number measurements, and to reinforce operations with decimals. Students could also be given measurements that are not all the same unit (e.g. $h = 9.1\ cm; w = 58\ mm; l = .18\ m$) to practice metric conversions.

After initial teaching, the cubic inches and rectangular prisms could be added to a measurement center. Students could explore volume at their own paces, measuring rectangular prisms and when applicable, checking the volume by packing them with the cubes.

Commentary:

Students may need help understanding the relationship between liquid volume and volume of rectangular prisms. Clarify that they are both describing an object's capacity, and that both can be calculated. The volume of a rectangular prism is the simplest to calculate, and indeed the volume of some shapes requires advanced mathematics.

Students may need clarity on the difference between 2-dimensional and 3-dimensional. The resurgence of 3-d movies could introduce some misconceptions, though it could also serve as an additional support.

There are many websites that offer nice visuals, including:

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http://www.mathsisfun.com/definitions/volume.html

http://illuminations.nctm.org/ActivityDetail.aspx?ID=6

If applicable, include worksheets, diagrams, student work etc. at end