Algebra/Geometry Institute Summer 2008

-Pump Up The Volume-

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Grade Level: 4th

1. Teaching Objective(s)

- Use appropriate tools to determine, estimate, and compare units for volume in English and metric systems.

2. Instructional Activities

a. Morning Math: Have students complete the "Question Cards" (see Attachment 1). Tell students to complete their cards, fold their card, and raise their hands when finished. Take-up all question cards.

b. Review from previous lessons by asking students to give you a definition and formula for perimeter and area of rectangles.

c. Say, "Today we are going to talk about volume." Give students a definition for volume. "Volume is the size of a three-dimensional solid or region of space.

d. Say, "The formula for finding the volume of rectangular prism is *L x W x H.*"

i. Activity I: Create a Model

1. Give each table a bucket of wooden blocks.
2. Give each table a certain number of blocks to use (Table 1 – 6; Table 2 – 12; Table 3 – 8; and Table 4 – 10).
3. Ask each student at each table to get the number of wooden blocks designated for their table.
4. Ask each student to construct a rectangular prism, but make it different from their table-mate's rectangular prism using all the blocks. (Give students time to build and observe their table mates.)
5. When students have constructed their rectangular prism, ask students to prove the volume of their rectangular prism by using the formula.

6. Say, "Everyone at your table has built a rectangular prism with the same volume, but your models do not all look the same."
7. Ask students to construct a rectangular prism without others looking. (Give student time to construct a model.)
8. Say, "Find the volume of your table-mates' rectangular prism using the formula for finding the volume of a rectangular prism."
9. Observe students using the formula for finding the volume of the rectangular prisms. For students who constructed models unevenly, show students how to decompose a model and find smaller volumes and then add all the smaller volumes.

ii. Activity II: Using What I Know

1. Using prior knowledge, ask students to give definitions or example of area and perimeter. Give your definitions of area and perimeter. (Area: amount of space measured in square units; Perimeter: distance around a shape.)
2. Using a shoebox, ask students questions about the shoebox to help distinguish between volume, area, and perimeter.
    a. How much paper must be used to cover the inside of the box? (AREA)
    b. How many cubic inch blocks will the box hold? (VOLUME)
    c. How much string will be needed to go around the box? (PERIMETER)
3. Ask students to picture a farm, and then ask questions about the farm to help distinguish between volume, area, and perimeter.
    a. How many feet of fencing are needed for the pasture? (PERIMETER)
    b. How much roofing material is needed for the barn? (AREA)
    c. How much grain will fill the bucket? (VOLUME)

iii. Activity III: What's In Your Bag?

1. Give each table a garbage bag, tape, and straws. Tell students that they are going to work as a group to complete this activity. (The groups would consist of the students at each table.)
2. Ask each group to designate a group captain and ask that captain to go to the front of the classroom.
3. Ask the remaining group members to get their garbage bags and smooth the garbage bag out on the table so

that there is no air in the bag. Then ask students to tape the opening of the garbage bag, by folding the opening over first, to ensure that no air come in or leaves out of the bag.

4. The remaining group members should also punch a small hole into the first layer of the garbage bag to insert their straw. When the straw is inserted, they should tape the opening of the hole to ensure that no air will exit the bag.
5. Tell group captains to go and sit on the bag at their group's table.
6. Tell students that they will now attempt to lift their group captain off the table by blowing air into the bag through the straws.
7. Ask students to be sure to keep up with the number of times they blow through the straws.
8. When all members are ready to begin, they may. Be sure to remind students to keep track of the number of times they blow into the straws. After students have blown for about a minute, tell students that they may stop when their group captain has been lifted off the table.
9. After all groups have completed the "What's in Your Bag" activity, give all students a "What's In Your Bag" worksheet.
10. Show students a measuring cup which has water filled to the 500 ml line. Tell students that the amount of volume in a normal breath of air is approximately 500 ml, the same as the amount of water in the measuring cup.
11. Have students complete the "What's In Your Bag" worksheet (see Attachment 2) with their group members.
12. After students have completed the worksheet, read some of the Question Cards from the "Do Now" activity.

3. Materials and Resources

a. Materials
   i. Question Cards
   ii. Wooden Blocks
   iii. Shoe Box
   iv. Tape
   v. Garbage Bags
   vi. Straws
   vii. Water
   viii. Measuring Cup (500 ml)
   ix. "What's In Your Bag" activity sheet (1 per student)

b. Resources:

Beaumont, Verne, Roberta Curtis, and James Smart. *How to – Teach Perimeter, Area, and Volume.* National Council of Teachers of Mathematics, 1986, pp. 25 – 32.

Using Manipulatives to Teach Mathematics, Carson-Dellosa Publishing Company, Inc., 1992, pp. 80 – 83.

4. Assessment

a. Observe students' participation and work during activity 1. (Check to see if students are constructing a rectangular prism; check to see if students are all building a different model from their table-mates'; check to see if students are using the formula correctly.)
b. Observe students' participation and work during activity 2. (Listen for correct responses to questions.)
c. Observe students' participation and work during activity 3. (Check to see if students have smoothed garbage bags; check to see if students have punched holes into garbage bags and if they have inserted straws into garbage bags; check to see if group captains are sitting correctly on garbage bags; and, check to see group members are blowing through the straws.)
d. Grade "What's In Your Bag" worksheets.

Attachment 2

Full of Volume

Activity III: What's In Your Bag?

1. Were you able to lift your group captain?

2. If so, how fast?

3. How many breaths of air did you release into the garbage bag?

4. How many breaths of air did your group release into the garbage bag in all?

5. The amount of volume in a normal breath is approximately 500 ml. Using this information, calculate the amount of volume in your group's garbage bag. Show your work.

Attachment 1

Question Card
Do you think it's possible to lift a person with a garbage bag, tape, and a straw?

YES or NO

Explain.

Question Card
Do you think it's possible to lift a person with a garbage bag, tape, and a straw?

YES or NO

Explain.

Question Card
Do you think it's possible to lift a person with a garbage bag, tape, and a straw?

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Explain.

Question Card
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YES or NO

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