Mathematics: The Language of STEM

Shipping Soccer Balls

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CONTENT AND TASK DECISIONS

Grade Level: 7th Grade Mathematics

Description of the Task: Students will use cubes to represent packaged soccer balls to fill a clear geometric cube manipulative (or a similar box that works with your cubes and dimensions) to "send" to a soccer team in order to understand the overall volume of the box.

Indiana Mathematics Content Standards:
7.GM.3: Solve real-world and other mathematical problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing. Create a scale drawing by using proportional reasoning
7.GM.6 - Solve real--world and other mathematical problems involving volume of cylinders and three--dimensional objects composed of right rectangular prisms.
7.GM.7 - Construct nets for right rectangular prisms and cylinders and use the nets to compute the surface area; apply this technique to solve real-world and other mathematical problems.

Indiana Mathematics Process Standards:
PS.1 - Make sense of problems and persevere in solving them.
PS.2: Reason abstractly and quantitatively.
PS.4 - Model with mathematics.
PS.5 - Use appropriate tools strategically.
PS.6 - Attend to precision.

Mathematics Content Goals: Students will better understand the concept of volume by filling a rectangular prism with cubes.

Language Objectives: With a partner students will discuss and record the volume of a rectangular prism using models, manipulatives, and drawings.

ELD Standard 3 - English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.

Materials:
- ISTEP+ Reference Sheet
- Snap cubes or Unifix cubes
- Soccer ball still in box packaging (optional)
- Large boxes (optional)

THE LESSON

Before:
Start out by grabbing students attention by saying, "Today we're going to be making a plan to send soccer balls and I need your help." First review with the students. "First, we need to review some mathematical ideas. In your groups (desks are already organized in cluster groups of 4) discuss and draw pictures of these ideas: perimeter, area, volume, length, width, height. Designate one person from your group to be the recorder." Be sure to have these words listed on the board or projector for all students to see visually. This will especially help our English Language Learners. This should help stimulate their past knowledge of those ideas. Have a share out/class discussion on their reportings.

During:
Begin the meat of the lesson by holding a soccer ball (optional) and explain to the students, "I have a problem and I need your help to figure it out. I am in charge of sending 12 packaged soccer balls in one box to my nephew's soccer team in Texas, your job is to design different boxes in the shape of rectangular prisms that UPS or FED EX might use to ship them. Remember that all 12 packaged soccer balls MUST fit in ONE box, and for this activity we are going to assume that each packaged soccer ball is 1 ft by 1 ft by 1 ft."

- Now let the students go to work.
- Tell students they will be partnered up (Depending on your class and the students you have, you may want to intentionally pair them up ahead of time by skill and/or language level.) and will be creating models with cubes to represent the boxes and packaged soccer balls. They need to use the manipulatives (cubes) given to build, draw, and label models of the boxes. They are to record their findings and observations.
    - They should build the model
    - Draw a representation of the boxes
    - Label the dimensions on the drawing
- As an extension activity for students who finish ahead of others, you could encourage students to figure out boxes (rectangular prisms) needed to send 24 packaged soccer balls, then 36, etc.

After:
In this portion of the lesson, students would share out their findings. They would have to prove and justify why their findings were correct with that of their peers. Students could also jigsaw and meet with a different partner to compare their findings. Ultimately this is where students would discuss and ensure that they indeed found the correct answers. Students would need to challenge and find solutions if there are group members that don't necessarily agree on the correct answer. On the other side of that, students also would need to justify that their solution is in fact correct. This is where students learn the best. Plan for plenty of time for this discussion to take place. The teacher, again, will serve more as a facilitator who roams around actively listening to each of the groups and how they are justifying their responses.

If students don't come up with the following question on their own during the class discussion, be sure to ask, "What is the volume of each of your boxes?" "What do you notice about the relationship between the dimensions of your boxes and the volume of your boxes?" "How can you justify or prove that?"

As an extension you could encourage students to think about the surface area of their boxes. Ask, "Which of the boxes you have created require the most cardboard material? What would require the least amount of material?" (You could simplify these questions for our language learners by asking: If you were to gift wrap the boxes (like a Christmas present), would it take more wrapping paper or less wrapping paper?) Be sure students justify their answers...Why do you think that? How do you know?

ASSESSMENT

Observe:
It is important for the teacher to roam around the room ensuring all students are on task and understanding the focus of the task. The teacher will serve more as a facilitator who roams around actively listening to each of the groups and how they are justifying their responses.
The teacher would specifically be looking for students to understand that the volume does not change no matter how you arrange the 12 packaged soccer balls.

Ask: Specific questions you will ask students to assess their learning.

1. What is the volume of each of your boxes?
2. What do you notice about the relationship between the dimensions of your boxes and the volume of your boxes?
3. How can you justify or prove that?"
4. What patterns did you see?
5. Which of the boxes you have created require the most cardboard material? What would require the least amount of material? (Simplify by saying: If you were to gift wrap these boxes (like a Christmas present), would it take more wrapping paper or less wrapping paper?)
6. Why do you think that? How do you know?