**Pump Up the Volume: How it’s Engaging for Students**

* This lesson addresses six of the eight Multiple Intelligences
  + Verbal-linguistic
    - Students have the opportunity to speak with their classmates and to write an explanation of their answers.
  + Logical-mathematical
    - Students formulate hypotheses, determine what information they have and what they still need, and calculate the volume.
  + Spatial and Bodily Kinesthetic (2 of the Multiple Intelligences)
    - Students use the paper to create a physical model of the cylinders.
  + Interpersonal
    - Students must work cooperatively with a partner to determine the volume of the cylinders (initial activity).
  + Intrapersonal
    - Students reflect on what they did, what worked/didn’t work (see worksheet).
* Inquiry Based Lesson
  + Developmentally appropriate and responsive for middle school students who:
    - Prefer active learning.
    - Are social creatures.
    - Have the capacity to be quite creative.
      * Powell, S. (2011). *Introduction to Middle School* (2nd ed.). Boston, MA: Pearson Allyn & Bacon. p. 208.
  + Students also formulate their own ideas, discuss their ideas with each other, and come to their own conclusions.
    - Students have to make a prediction which cylinder has the largest volume. Then they are to calculate the volume.
    - Students get to choose how they approach the problem and then share their ideas/reasoning with the class.
* This particular lesson also allow students to see the real-world application of the concept. (Relevance)
  + As an adult, I often grab the wrong size container and have either too much room or not enough room for my leftovers. If I would take a moment and do the math, I could easily determine the appropriate container. If I did not have the inclination to calculate the volume, I could also use my conceptual understanding of volume to determine which container is larger.
  + Towards the middle of the lesson, we bring the discussion back to the opening problem of the soup and the too-small cylindrical container and ask students to consider the possibility of change the dimensions of the container to increase the volume so that the soup will fit.
* The performance task also allows students to problem-solve rather than going through a formulaic approach. They get to decide how to solve the problem. (Rigorous).
* So much of math is what one teacher has called “plug and chug,” but this lesson approaches math from a science like perspective; it’s exploratory.
  + We all remember lab days in science being the best; not the boring lectures. This activity takes that approach. Students get to “discover” how changing the height and therefore the circumference of a container effects the volume.