Zeus’ Challenge Lesson Plan

Amount of time Demo takes: 7 mins.
Try this at home!

Materials
- 5 gallon carboy
- 4 gallon "test" carboy
- 3 gallon carboy
- Two "well" buckets
- One set of funnels
- One "caution: wet floor" sign
- Isopropyl alcohol
- Whiteboard and markers for score keeping
- Stopwatch

Set-up Instructions
1. Fill the well buckets with water.
2. Set out the funnels and carboys.
3. Set the test carboy out of sight of the participants until they are ready to test their guess.

SAFETY!
- If any water spills, put out a 'wet floor' sign and warn people against slipping.
- Don't let anyone drink the water.

Lesson’s Big Idea
- The challenge is to get exactly 4 gallons of water in the test carboy, using only a 5 gallon and 3 gallon carboy.

Background Information
- This challenge is a simple mathematical problem with the numbers replaced by physical quantities.
- Removing the abstract nature on numbers from the problem and replacing them with something physical lets those who typically struggle with math,
dislike math, or identify as anti-math to solve the problem in a new way.

- Don't frame this challenge as a math problem, but as an action problem. We want to engage those that shy away from math problems and show them that math doesn't always mean pages of numbers.

**Instructional Procedure**

1. Challenge the participants to pour precisely four gallons of water into the test bucket, using only a five gallon and three gallon carboy.

2. Depending on the participants age and comprehension, challenge them to a time trial. If there is more than one participant, challenge them to compete for time or challenge them to find an alternate solution. There are two solutions below.

   a. **Solution One:**
      1. Fill up the 3 gallon jug, then pour it into the 5 gallon jug.
      2. Fill up the 3 gallon jug again, use it to fill the 5 gallon jug up leaving 1 gallon.
      3. Pour out the 5 gallon jug back into the well, and pour the 3 gallon jug into the 5 gallon jug. This leaves 1 gallon in the 5 gallon jug, and an empty 3 gallon jug.
      4. Fill the 3 gallon jug.
      5. Pour the 3 gallon jug into the 5 gallon jug, leaving 4 gallons.

   b. **Solution Two**
      1. Fill up the 5 gallon jug.
      2. Use the 5 gallon jug to fill the 3 gallon jug, leaving 2 gallons.
      3. Pour the 3 gallon jug into the well. Pour the 5 gallon jug into the three gallon jug. This leaves 2 gallons in the three gallon jug, and the 5 gallon jug empty.
      4. Fill the 5 gallon jug and pour it into the 3 gallon jug. Only 1 gallon will fit, leaving 4 gallons.

3. Once they think they have a solution, ask if its their final answer. If the challenge is timed, stop the clock when they say yes.

4. Pour their guess into the 4 gallon carboy, see how close they were.

5. Record their time. Be positive if they miss the mark, getting a math question wrong in front of strangers and peers can bring a kid down. What we want to do is remove the stigma of math as intimidating. Break the answer down so they can understand it.
6. If there is no line, they can retry or seek another solution.

**Assessment/sample questions you can ask**

1. How many solutions are there?
2. Can you represent this challenge with numbers?
3. What are other ways we have to use math every day?

**Clean Up**

- Dispose of all the water appropriately.
- Clean and dry everything to the best of your ability. If possible, leave wet items out to dry.
- Swish a couple milliliters of alcohol around the carboys, then pour it out. This will sanitize the carboys of bacteria or mold, as well as accelerate drying.
- Place carboys back in the bin with caps removed, so they might dry thoroughly.

**References**

- Die Hard: With A Vengeance

**Next Generation Science Standards**

- K-5
  - K-2-ETS1
  - 3-5-ETS1
- 6-8
  - MS-ETS1