Bite 1: Scientific Method

This lesson we're going to talk about the scientific method. The scientific method is a series of 5 steps that scientists use to do research. But, honestly, you use it every day too!

The five steps are Observation, Hypothesis, Test, Collect Data, and Report Results. That sounds pretty complicated but don't worry, they are just big words. Let me tell you what these words mean and then we'll play with them.

Observation means what do you see, or hear, or smell, or feel. What is it that you're looking at? Is that what it usually does? Is that what it did last time? What would happen if you tried something different with it? Observation is the beginning of scientific research. You have to see or touch or hear something before you can start to do stuff with it right?

Once you observe something, you can then form a hypothesis. **All hypothesis really means is "guess". Hypothesis is an educated guess.** Tonight at dinner, when someone asks you "Do you want peas or carrots?" Say, "I hypothesize that I would like the carrots." Everyone will think you're a genius! Basically you're saying "I guess that I would like the carrots". Hypotheses aren't right or wrong they are just your best guess.

To see if your guess is correct, you need to do the next step in the scientific method, test. **The test is just what it sounds like; running experiments to see whether or not your hypothesis is correct.** We'll talk in more detail about tests in the next lesson.

As you do your tests, you need to **collect data. That means collecting the numbers, the measurements, the times, the data of the experiment.** Once you collect your data, you can take a look at it, or in other words analyze it.

Once you analyze your data you can **report your results. That basically means tell someone about it.** You can put your data in a chart or a graph or just shout it from the rooftops!

Here's a great way to remember the 5 steps. Remember the sentence "Orange Hippos Take Classes Regularly". The first letter in each word of that goofy sentence is the same as the first letter in each step of the scientific method. That's called a mnemonic device. Make up your own to remember all sorts of stuff.

"Ok, so that's what the words mean. How do I use that everyday?" Well, I'm glad you asked that question. If you had cereal for breakfast this

morning, you did the scientific method. On the table you had a bowl of cereal with no milk in it. As you looked at your dry cereal, you made an observation, "I need milk!" At that point, you made a hypothesis, "There's milk in the fridge." You can't be sure there's milk in the fridge. Someone might have used it up. It might have gone bad. Aliens may have used it to gas up their milk powered spaceship. You just don't know! So you have to do a test. What would be a good test to see if there is milk in the fridge?....Open the fridge! Now once you move the week old spaghetti and the green Jell-O (at least you hope it's Jell-O) out of the way, you can see if there is milk or not. So you collect your data. There is milk or there isn't milk. Now you can finally report your results. If there is milk you can happily pour it on your cereal. If there isn't any milk you report your results by shouting, "Hey Mom...We need milk!" Scientific method, not so hard is it?

Now that you have some idea what the scientific method is, let's do some stuff with it. The first experiment we're going to do is the Diabolical Diaper Dilemma.

Experiment 1
Diabolical Diaper Dilemma

What you need:

- Disposable Diaper (any size)
- Water
- Large Bowl or Sink
- 1 Cup Measuring Cup
- 2 People

What we're going to do here is find out how many cups of water can be held by this diaper.

1. Make an observation. How big is the diaper? What brand? How thick etc?

2. Make a hypothesis. How many cups will the diaper hold? One, five, twenty-seven? Remember, this is your hypothesis, not your conclusion. It's OK if you're not right. If you already knew how many cups this diaper would hold, you wouldn't be doing this experiment would you?

3. Begin the test. Open up the diaper and hold it over the sink or bowl.

4. Slowly pour one cup of water into the diaper. Be sure to pour it all over the inside of the entire diaper.

5. Continue to pour water until the diaper no longer soaks it in. Take your time. It soaks in slowly. Collect the data. Count how many cups you're pouring into the diaper.

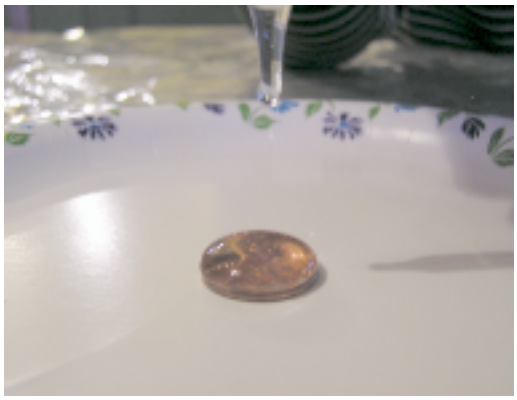
6. Once the diaper cannot hold any more water, report your results. Cry from the rooftops. Call the press, or just state out loud how many cups it took to fill the diaper. How close were your results to your hypothesis? Remember, if they don't match it is absolutely fine.

Are you surprised? That's one heavy diaper! That's a lot of water!

If you would like to do more with this, you could try to find out how much water different brands of diapers hold (remember to use diapers rated for the same weights of child.) Not only are you doing science, you're doing consumer research!

Experiment 2
Drops on a Penny (A.K.A. Underwater Presidents)

How many drops of water can a penny hold?



What you need:

Pennies
Eye or medicine dropper
Water

1. Make your observations of the penny; the size, the cleanliness, heads or tails etc. Next look at the water dropper? How big is the opening? How big are the drops that come out, etc?

2. **Make your hypothesis. Make a scientific guess as to how many drops you can get on that penny before the water drips off the penny. Unless you've done this before, you will almost certainly have a hypothesis that is not very close to your results. Don't worry about it.**

3. **Do your test. Slowly but surely put drop after drop on that penny. Eventually you will see a surprisingly large mound of water on the penny that will burst and overflow.**

4. **Collect your data. Keep a careful count of how many drops are sitting on that penny. For accuracy's sake, you may want to do this several times (besides, it's fun) and average your results. (To get an average, add up all your results and then divide by the number of results you got. For example, if you did the experiment three times and got the results 14, 16, and 30 you would add those numbers together (60) and then divide that by 3 (the number of results). So your average would be 20 drops.)**

5. **Report your results. Once the water spills over the edge, construct an interplanetary telecommunications device to broadcast your results across the universe....or you could just tell your kid brother. It's up to you.**

I've seen folks get more then 70 drops on a penny! Pretty amazing really. The average seems to be between 30 and 40. The reason the water mounds up like that is because water really likes to stick to itself . It takes a good amount of weight before the water breaks apart.

Would you like to do more with this experiment? What would happen if you used different coins? Is there a mathematical relationship between the number of drops and the size of the coin? Is there a difference between the head side and the tail side of the coin?

Experiment 3
Balancing Bird

Can you get a paper bird to perch on its beak?

What you need:

- **Card stock or cardboard**
- **Bird Stencil (see illustration)**
- **2 paper clips**
- **Paper**
- **Pencil/ pen**

Before you do this experiment you need to make a bird, like the one below, out of a piece of card stock or thin cardboard (something at least as thick as 5 sheets of paper). An old cereal box or file folder would do the trick nicely. Your challenge is to use the paper clips so that the bird will balance when you put you finger under the red dot on the bird's beak. The bird will sit flat on the edge of your finger when you get it right.

1. **Carefully observe the bird and the paper clips. What do they weigh? What's their size etc?**

2. **Make your hypothesis. Take a piece of paper and draw 5 or 6 bird shapes on it. Draw two lines on each bird that represent where you will put the paper clips. Each drawing will be one hypothesis for what will make the bird balance.**

3. **Test your hypothesis. Put paper clips on your bird where you put the lines in your hypothesis. Now put your finger under the dot and try it. Did it balance? If it did, great. Now try another hypothesis. If it didn't, great. Now try another hypothesis.**

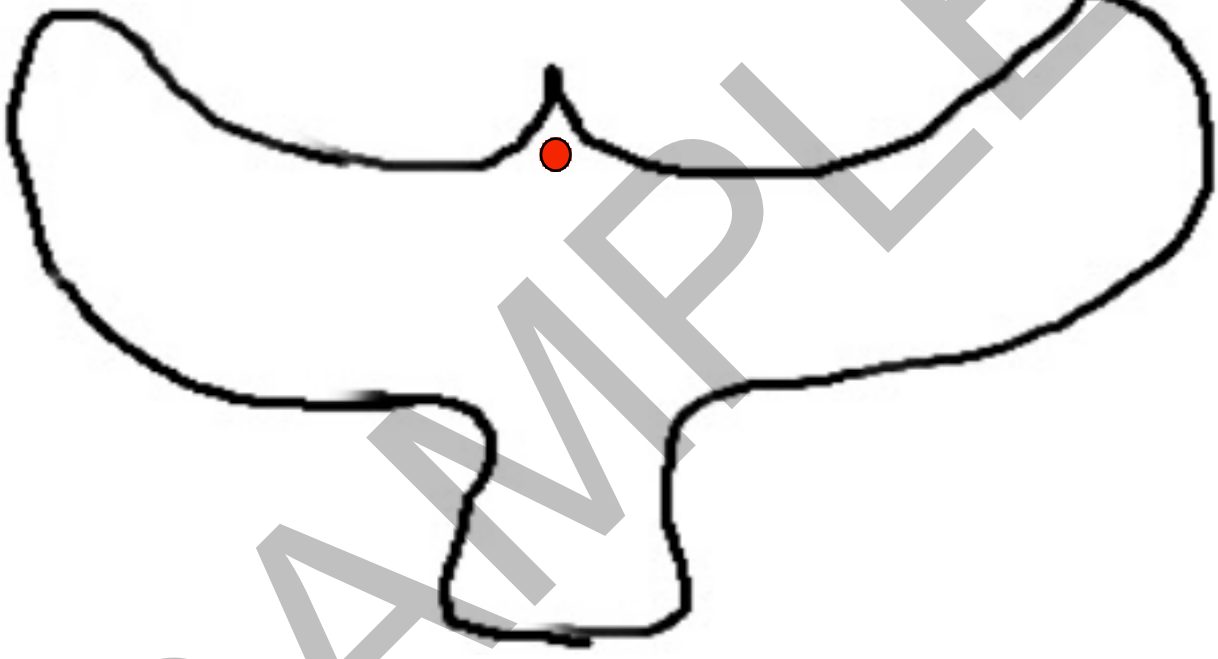
4. **Collect your data. As you do your tests, draw a circle around the hypotheses that work and cross out the ones that don't.**

5. **Report your results. Use the hypotheses that worked and parade around**

town with the bird on your finger proudly announcing your earth shattering scientific find. Or just be filled with that warm cuddly feeling you get when an experiment goes well.

I've seen a few results that work but the most popular is with the paper clips on the very tip of each wing.

If you'd like to do more with this, try to get it to work with 3 paper clips. How about 4 or even 5? What happens if you change the size of the paper clips?



The next time you're about to do something around the house apply the scientific method to it. For example, if you're about to write something you could apply the scientific method by saying, "I observe that I need a pencil. I hypothesize that there is a pencil in my drawer. I will test this by opening my drawer. I will collect data by looking in the drawer. I will report my data by writing with my pencil or by asking mom where the pencils are." How could you apply the scientific method to making a peanut butter and jelly sandwich, or walking into a dark room, or buying an ice cream cone? Can you think of others?