**Nature of Science & Engineering: Conducting a Scientific Investigation Notes**

September 22nd

**The Scientific Method & Engineering Method**



The Scientific Method

* Step 1
	+ **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
	+ For example: “I wonder what type of bird seed I should put in my feeders.”
* Step 2
	+ **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
	+ Head to the library for resources, do online research, ask someone at a retail store that sells bird seed
* Step 3
	+ **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
	+ An Observation is noting or detecting phenomenon through the senses.
	+ Spend time watching birds in the wild or at other feeders.
* Step 4
	+ **Construct a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ based on an \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.**
	+ A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is a suggested explanation based on evidence that can be tested by observation or experimentation.
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ statement
	+ “If birds like a variety of seeds in the wild, then they prefer a mixed seed at the feeders.”
* Step 5
	+ **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
	+ An \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is a special type of investigation that is performed under \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to test a hypothesis
* Step 5 (con’t)
	+ Test **Variables** - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ Two types:
		- **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** – the variable in an experiment that is being measured.
		- **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** – the variable in an experiment that is being changed to observe the effect on the dependent variable.
* Step 5 (con’t)
	+ Bird Seed Experiment:
		- Dependent Variable: **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
		- Independent Variable: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ You will record the amount of bird seed consumed by the birds for each of the different types of seed.
	+ You will offer at least two different types of seed for the birds.
		- Mixed seeds (going back to your hypothesis)
		- Another type of seed based on your background research and/or observations (maybe sunflower seeds)
* Step 6
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ Have step by step detailed instructions on how to set up and run the experiment so that anyone can duplicate it
	+ Step 1: Set out two identical bird feeders – one with 8 cups of mixed seed, one with 8 cups of sunflower seeds
* Step 7
	+ **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** – is the procedure working?
	+ If not, figure out \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to better answer your question.
	+ Are squirrels getting to the feeders and eating all the seeds? You may need to change the location of the feeders.
	+ Note changes to the procedure.
* Step 8
	+ **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
	+ Be sure to collect enough data – make observations at least \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ For example: set out, collect and weigh the remaining bird seed three times and calculate the average amount of seed left over
* Step 8 (con’t)
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	+ Make charts, graphs, tables, etc. to show your data
	+ Do not make tables and graphs that show the same thing!
	+ For example:
		- Make a graph comparing the amount of seed left over from the three trials from each bird feeder
		- Make a table showing the average amount of seed left over
* Step 9
	+ **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**– the data you collected!
	+ Show these using your graphs, charts, tables, etc. AND **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** those tables and results.
* Step 10
	+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ – What did you learn from your results?
	+ Can you accept your \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_?
		- Do birds prefer mixed seeds at bird feeders based on your experiment?
	+ You may have to \_\_\_\_\_\_\_\_\_\_\_\_\_ your hypothesis. (And that’s okay!)
	+ If you reject your hypothesis, how can you retest?
	+ What changes would you make to your experimental method?
* Step 11
	+ **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
	+ Presentation! Report!
	+ Compile all your hard work – question, research, hypothesis, materials, procedure, results, and conclusion – and present it to classmates, coworkers, etc. in the form of a research paper or presentation