

# Scientific Method

<b>Problem</b>	What are you testing for?
<b>Hypothesis</b>	What is your prediction?
<b>Experiment</b>	What did you do & how?
<b>Observations</b>	What did you <sup>observe</sup> measure and record?
<b>Conclusion</b>	What did you find out and how can you prove it?

## Problem Question

- Tests for a **single independent variable**
  - What you change/want to test
  - What makes 1 group different from normal
- Proposed in a **question????**
- Complete sentence/thought
- Can actually be **tested**

## Problem Question-Samples

**Good Question:** *Does drinking Monster energy drink increase the rate at which you read science content compared to not drinking monster?*

(1 variable/1 control /specific task)

**Poor Question:** *Will Monster energy drink, exercise, and classical music improve your rate of reading?*

(too many variables/not specific about the task/  
what is being read!?)

## Hypothesis

- **Educated Guess/Prediction**-Based on background information
- Takes a stand! Not a Maybe...
- **Answers your problem question in future tense**
- Complete Sentence & ends in a period.
- O.K. if its wrong :)

**Good Hypothesis:** *Monster energy drink will improve the rate at which I read science content compared to drinking none.*  
(firm statement)

**Poor Hypothesis:** *I think Monster energy drink might increase the rate at which I read science content*  
(wishy - washy / not a statement)

## Control Group

- Normal Condition
- Does not change / Remains constant
- Used as a **comparison** to your experimental group

### Example:

Control:  
Drinking nothing

No Change:  
Reading rate (used as the comparison to experimental group.)

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## Experimental Group

- Changed condition
- This is where you find out if your change makes a difference
- 1 variable is altered
- The tests you are performing

### Example:

Variable:  
Drinking monster

Change:  
Reading rate.

## Experimental Procedure:

A complete set of directions on how to set up & complete a task

- Lists all materials and quantities of materials needed to accomplish procedure (separate section usually)
- Written in chronological *Time* order/numbered list
- Describes what you need to do in detail & pictures always help!
- Depends on your audience how much detail you need to include
- How to complete any task

### In life you see procedures

- Directions to play a game
- Driving directions
- Build or assemble something
- Standard Operating Procedures (SOP's)
- Explaining how to do something
- Lawyer, doctors, accountants, hair dressers, mechanics, fashions designers, everyone!

# How To Make a Peanut Butter Sandwich (example 1)

It is relatively easy to make a peanut butter sandwich if you just follow these simple directions. All you need is peanut butter, two pieces of bread, and a knife.

First you get the bread and peanut out of the cupboard and the knife out of the silver ware drawer. The second thing you do is to put the pieces of bread side by side. Then you open the jar, stick the knife into the jar and bring out a bit of peanut butter. Now spread it on one piece of bread.

Next repeat these last two steps until the peanut butter is spread about one eighth inch thick all over the piece of bread. Then you put the piece of bread with no peanut butter on it and place it on the piece of bread with peanut butter on it.

Next you scrape the excess peanut butter that stuck on the knife on the side of the opening of the peanut butter jar. Now cut the sandwich in half crosswise with the knife. Then clean the knife or put it in the sink. Put the peanut butter jar back in the cupboard.

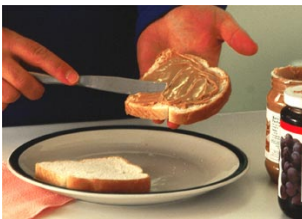
Finally eat your peanut butter sandwich.

Compare to example 2,  
how are they  
different???

2 slices bread  
1 knife  
1 plate

1 jar peanut butter  
1 jar jelly  
1 napkin

## How To Make a Peanut Butter Sandwich (example 2)



### Step 1:

Using a knife, spread a generous layer of peanut butter on one slice of bread.



### Step 2:

Clean the knife with a napkin or use another knife so the peanut butter and jelly don't mix in their containers.



### Step 3:

Spread jelly or jam on the other slice of bread. Use slightly less jelly than peanut butter

### Step 4:

Put the two pieces of bread together with the peanut butter and jelly sides facing one another. Cut the sandwich in half for easier eating.

In Notebook:

9/06/2011

Comparing directions-PB & J

1. What made the 2nd example better than the first example?

*The 2nd example was better than the first because*

2. Why would people make fewer mistakes?

*People would make fewer mistakes because*

Observations/Data: ~~"Because..."~~

• Just the facts from the experiment—  
NO interpretations or inferences!

• May include diagrams, charts, graphs, pictures, etc.

• Includes measurements (data) & qualitative <sup>(descriptive)</sup> observations (descriptions)

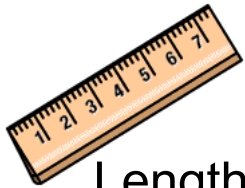
• Record, organize, & display results  
(table, chart, other...)

*Helps you see patterns & changes*

Simple Definition  
Observation using  
-numbers  
-measurements,  
-percents, etc...

Example(s)  
grew 6cm  
31 mph  
164.3 grams  
84% of the plants

## Quantitative Data

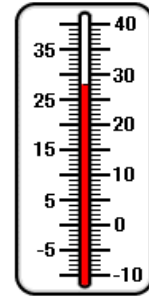


Length



Volume

Temperature

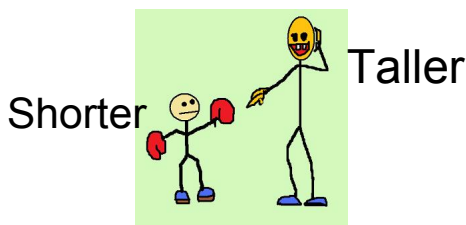


Not in packet

Simple Definition  
*Description*  
Observation that  
does **NOT** use  
numbers

Example(s)  
**Turned Red**  
**Grew Taller**  
**Went faster**  
**Small change occurred**

## Qualitative



Picture/Diagram

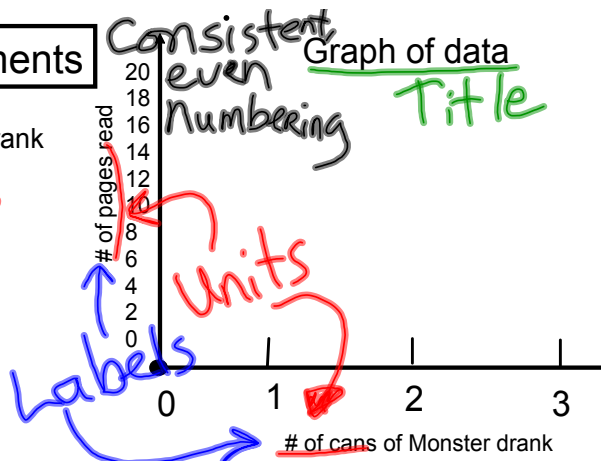


Leaf Shape or Size

Not in packet

**Data:** quantitative/measurements

	# of pages read in 20 minutes	# of cans of Monster drank before reading
1.	8	0
2.	10	1
3.	15	2
4.	12	3



**Observations:** qualitative / using your 5 senses/description

- vision blurred slightly during trial 3
- the student felt very full during experiment and needed to use restroom during trial 3
- the student could not stay focused on reading during trial 3
- the student drank orange monster energy drink

## Conclusion/Analysis:

**Conclusion:** - short & to the point

- States if Hypothesis is correct or not (ok if it is wrong :)
- Answer the Problem Question
- Must include data & observations to prove your findings

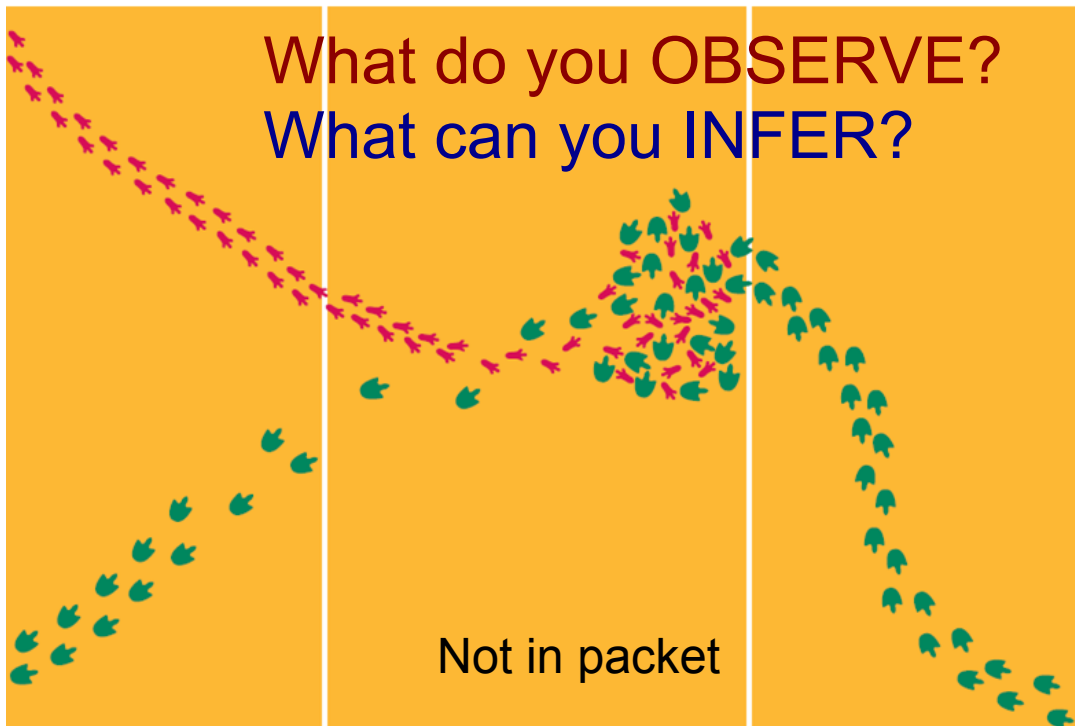
**Analysis:** So what? Section The "Because" Section

- What** do your results mean? and **Why** did you get what you got? (connection to the unit or concepts covered)
- Inferences** belong here (because this...then this.)
- Possible **application/importance** of what was discovered

**Experimental Errors**, both real & possible, are recorded.

- Comment on **importance** of errors-Did they make a major or minor difference?

Tracks like these are common in parts of New England and in the southwestern United States.



Situation:



**Inference:**

an educated guess based on the observations and facts available. Past experience or background knowledge are helpful.

Example

**Observation:**

Using your 5 senses (hear, touch, taste, smell, & see) to gather data and information .

Example

*Based on the data collected when drinking monster energy drink, the rate at which a student can read does increase. My hypothesis that my rate of reading increased when drinking monster energy drink, was correct based on the following:*

- You are able to read more pages after 1,2,or 3 cans of monster, when compared to drinking none.*
- This is shown in the data that the student read only 8 pages when drinking nothing, but read 10,15,12 pages when drinking monster.*

*However, after an excess of 3 cans of monster, rates of reading start to decrease, so possibly drinking more than 2 cans would not be beneficial.*

*The reason for the increased rate of reading is that there is more sugar and caffeine in the students body, which helps them to be more alert and improves focus. But as mentioned above, if the body is overloaded with sugar and caffeine, concentration could decline.*

## **Faster than a Speeding Chicken:**

1. Read the article
2. Answer the two questions that follow on the page.
3. Be prepared to share with class.

not in packet

## Attachments

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Table 8.1 adaptation.doc

Observation\_Inference\_8th[1].ppt