The Scientific Method

How do you solve problems?

How do scientists carry out valid investigations?

How does the scientific process apply to real-world scenarios?

What is the Scientific Method?

The process of discovering the cause and effect of some interesting phenomenon we have witnessed…

How scientists figure out the answers to their questions through experiments!

Note that the Scientific Method gives scientists (and us) a guided order to follow. However, scientists may bounce back and forth from step to step if they hit an obstacle along the way…in other words, the process is always "Under Construction"

Steps of the Scientific Method

1

2

3

4

5

6

Steps of the Scientific Method

Make an Observation

Develop a Problem

Construct a Hypothesis

Conduct the Experiment

Collect and Analyze Data

If the hypothesis is true

If the hypothesis is FALSE or partially true

Form a Conclusion based on results

Think about it and try again

Ex.

OUR PIZZA HAS EXTRA DELICIOUS CHEESE

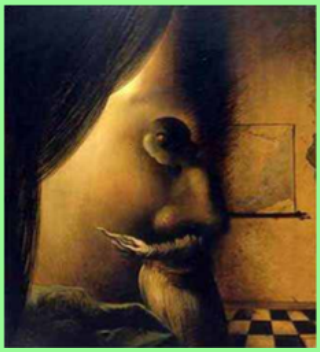
Observation

S

you ask a question.

S

An observation is any information you gather through your senses.



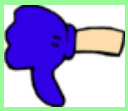
Name 3 observations based on these pictures.

BACK

Problem

Once you have observed something, it forces you to ask a testable question???

Be sure to give specific criteria and conditions



Should <u>not</u> be a “YES” or “NO” question

You can use HOW, WHAT, WHEN, WHERE

The problem is the PURPOSE behind the experiment

Which PROBLEM(S) are testable?

Do gorillas eat food? NO

How many pounds of bananas do adult male gorillas eat in 1 week? NO

Do gorillas recycle bananas? YES

BACK

Hypothesis

A likely explanation to a problem

A hypothesis must be logical, testable and direct!

How to form a Hypothesis

To crea on
about the outcome of the experiment and include
both variables of the experiment.

If we conduct an experiment to examine the relationship between a construction worker's age and their ability to hammer together 2 x 4s...what would a likely hypothesis be?

The younger the construction worker the more 2 x 4s they are likely to hammer.

Variables of the Experiment

Drag the 2 x 4s to the opposite corner

BACK

Experiment

Th n!

Drag the hammers to the nails

Creating a procedure, or set of # steps, that allows you to test the variable.

Gathering data in an organized table or chart

Setting up and creating a graph that allows a reader to better understand the results

BACK

Data

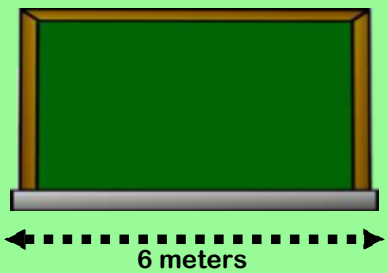
Data is the information you gather from your experiment.

It is the information you gather to show evidence that supports or rejects your hypothesis.

There are two kinds of data:

Quantitative data involves a number, or quantity

Ex: The chalkboard is 6 meters long.



Qualitative data does not have a number

Ex: The chalkboard is green

With a partner, discuss 2 pieces of quantitative data and 2 pieces of qualitative data you can gather from the picture below.

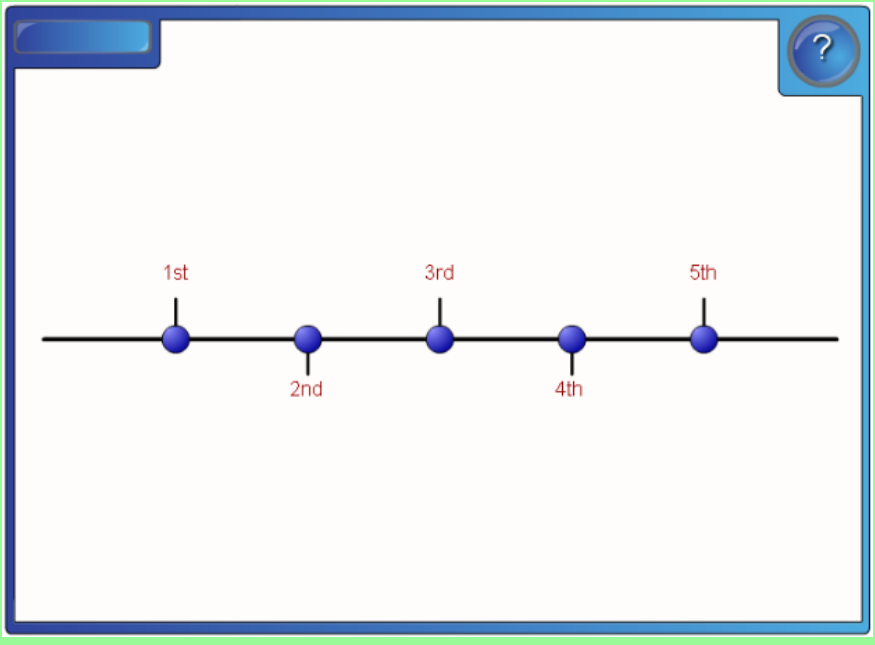
Quantitative

itative

BACK

Conclusion

At the (s formed based on the data you have gathered.



Controlling the Experiment

For an experiment to be considered valid, it must be controlled.

That means that all things are kept the same, or are alike, except the variable being tested.

Each experiment tests only 1 variable.

Parts of an Experiment

Drag each screw to the corners

Independent Variable:
The factor in the experiment that is changed, or the thing you are testing

Control Group:
The group that acts like a baseline measurement to compare the results to

Dependent Variable:
The factor in the experiment that is being measured, or the result of changing the independent variable

Experimental Group:
The group being tested on or receiving the IV

Let's Practice:

A school principal is concerned with the amount of students that drink energy drinks on the campus. He wants to find out if they really do improve a student's alertness, and therefore their grades. He decides to conduct an experiment to test his hypothesis that energy drinks do not improve student success.


With parent approval, he asks 100 seniors to participate.
He divides them into 5 groups:

1 2 3 4 5


IV?

Type of Energy Drink

DV?

Student Success

Control Group?

l: No ergy rink

Experimental Group?

AMP
Monster
RedBull
Rockstar

What are constants?

Click to reveal

What are some possible constants in the Energy Drink Experiment?

How much each person drank, GPA History, Diet, gender, etc.

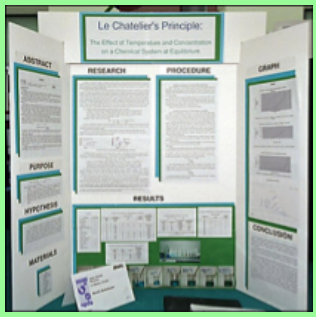
With a partner, generate a list of constants for an experiment that examines the relationship between heart rate and exercise.

- Gender
- Type of Exercise
- Duration of Exercise
- Intensity of Exercise
- How heart rate is measured
- Activity Level prior

n investigation was done to see if keeping the hts on for different amounts of time each day fected the number of eggs a chicken will lay.

Amount of time lights were left on	**IV**
Number of eggs layed	**DV**
Chickens exposed to intervals of light each day	**E.G.**
Chickens exposed to no light during the day	**C.G.**
Species of chicken, environment, food, age, etc.	**Constants**

What happens after an experiment is over?



Pull

A theory is a hypothesis that has been supported through experiments and observations numerous times and is generally accepted to be true by the scientific world.

The Language of Scientists

There are certain occurrences in life that scientists observe to be constant or regularly occurring in nature.

A law is a natural phenomenon that has been proven to occur invariably…that is ALWAYS.

Pull

Theory vs. Law

Hypotheses that have been supported by many scientists

The end results of the Scientific Method

More complex, dynamic

Accepted to be true by the scientific community

True

Universal

Usually mathematically based

Naturally occurring

Foundation of all science

A Theory is like an Automobile: Parts of the car can be changed or improved upon, without changing the overall truth of the theory as a whole.

A Law is like a Slingshot: it has one moving part, the rubber band. No matter what, the slingshot will release an object at a predictable speed.