The Nature of Science

Scientific Processes

Science is...

- the **observation** and **investigation** of the **natural world** and the **new information** that results from these investigations.

- Observation uses our senses and technology that enhances our senses.

Science is...

The **scientific process** is a general set of steps that helps scientists perform investigations.

- An **observation** leads to a **question**.
- A good scientist always does **research** to see what information is already available.

Science is...

- A **hypothesis**, or **educated prediction**, is an answer to the question that can be **tested**.
- The **experimental procedure** is used to test the **hypothesis**.

Experimental Design

Groups in an experiment:

- The **control group** receives no treatment.
  - Nothing is changed; it is the “normal” group.
  - It serves as a standard against which other groups can be compared.

- The **experimental group** has something changed. This factor is usually related somehow to the question.

Sun

No sun

Experimental Design

Factors in an experiment:

- Any factor that changes is called a **variable**.
- The **independent variable** is changed by the **scientist**. This can also be called the cause or the manipulated variable. There should be only **ONE**!
- The **dependent variable(s)** changes in response to the treatment. These factors are measured by the scientist. This can also be called the effect or responding variable.
- **Constants** are factors that do not change. They should remain the same for all groups.

Types of data

Data is the information obtained from an investigation.

Science uses two types of data:

- **Quantitative** data uses numbers.
  Ex: age, weight, distance, temperature - made with instruments

- **Qualitative** data uses descriptions.
  Ex: categories, observations, personal ratings, sensation words (hot, cold, soft, sour)

- Qualitative data is subjective, while quantitative data is objective.

What kind of data?

Height of 1st graders

Eye color

Spiciness of food

Age of Olympic athletes

Volume of sound

Attractiveness of a flower

Group size

Temperature of coffee in a cup

Temperature of coffee in your mouth

Type of learning style

Customer opinions

Annual income

Softness of a new mattress

Cost of a new mattress

Experimental Analysis

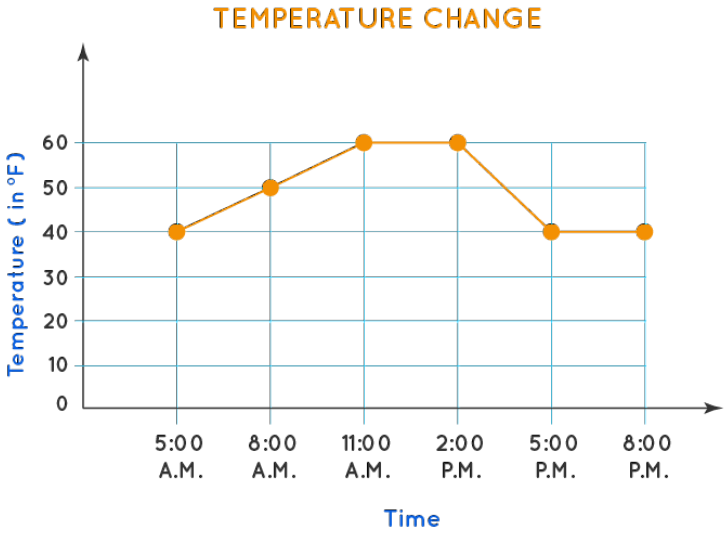
A **bias** is an **systematic error** introduced into the experiment by selecting or encouraging one outcome over another.

- Blind study - the subjects do not know which treatment was received.
- Double-blind study - neither the subjects nor the researchers know which treatment was received.

Visualizing Data

Charts and graphs assist in organizing and displaying data in a useful and understandable way.

- **Line graph** - used to show continuously changing data; change (Y) over time (X)



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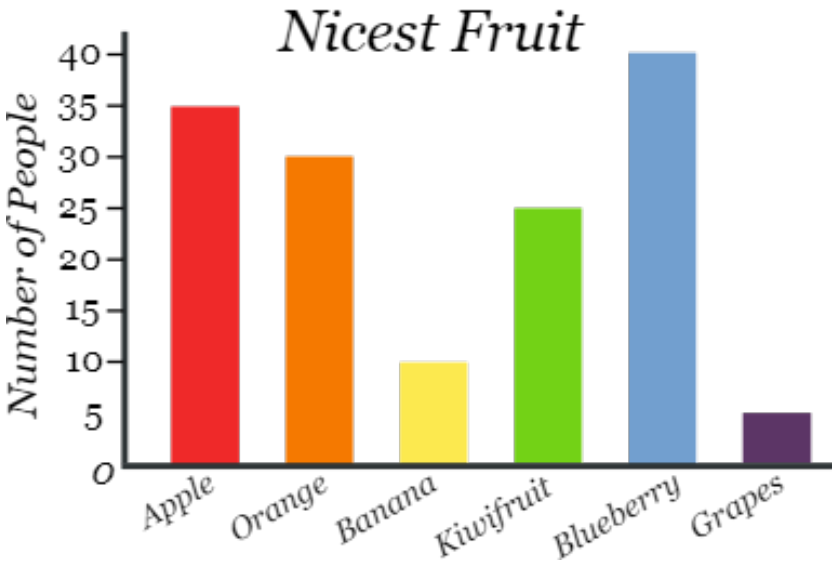

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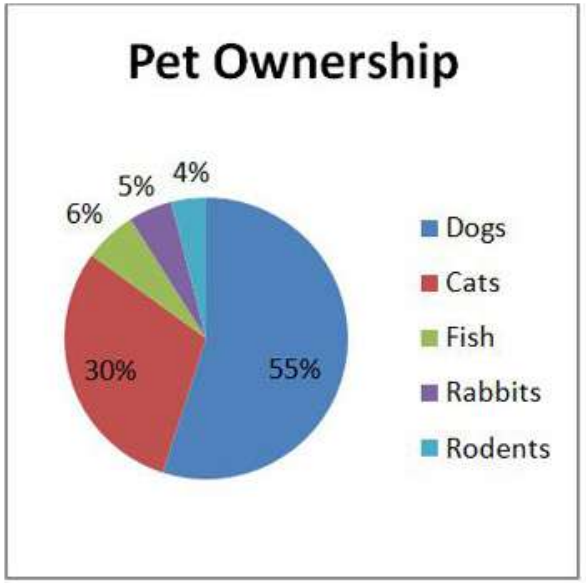
- **Pie Graph** - shows the % of the whole group



Finishing up

Observations

- Made with the senses
- Made with technology that extends our senses

Inferences - logical explanations

- Drawn from prior knowledge
- Drawn from prior experience

Critical thinking - the process of comparing new information with what you already know