# 4.1 & 5.1 - SCIENTIFIC INVESTIGATION

(CURRICULUM FRAMEWORK- 4.1 & 5.1 CONDENSED AND COMBINED)

➢ Science demands *evidence*. Scientists develop their ideas based on evidence and they *change their ideas* when new evidence becomes available or the old evidence is viewed in a different way.

➢ Science uses both logic and innovation. *Innovation* has always been an important part of science. Scientists draw upon their creativity to visualize how nature works, using analogies, metaphors, and mathematics.

➢ Scientific ideas are *durable yet subject to change* as new data are collected.

➢ Scientific knowledge represents the *current consensus* among scientists as to what is the best explanation for phenomena in the natural world.. To build a consensus, scientists communicate their findings to other scientists and attempt to replicate one another's findings.

➢ An *observation* is what you see, feel, taste, hear, or smell.

➢ An *inference* is a tentative explanation based on background knowledge and available data.

➢ A scientific *prediction* tells what may happen in some future situation based on the application of factual information and recognition of trends and patterns.

Observation
This lion has big teeth.

Inference
This lion is dangerous.

➢ A *conclusion* is a summary statement *based on the results* of an investigation (*verifiable observations*).

  ✓ distinguish between inferences and conclusions.

➢ *Elapsed time* is the amount of time that has passed between two given times.

➢ An *experiment* is a *fair test* driven by a hypothesis. A fair test is one in which *only one variable* is compared.

➢ A *hypothesis* is an educated guess/prediction about what will happen based on what you already know and what you have already learned from your research. It must be worded so that it is "*testable*."

  – The hypothesis can be written as an "*If…, then…." statement*, such as "If all light is blocked from a plant for two weeks, then the plant will die."

➢ An *independent variable* is the factor in an experiment that is altered by the experimenter. The independent variable *is purposely changed or manipulated.*
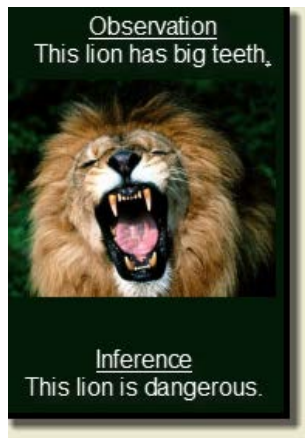
➢ A *dependent variable* is the factor in an experiment *that changes as a result* of the manipulation of the independent variable.

➢ The *constants* in an experiment are those things that are purposefully not changed and *remain the same* throughout the experiment.

➢ In science, it is important that experiments and the observations recorded are *repeatable*.

  ✓ judge which, if any, data in a simple set of results (generally 10 or fewer in number) appear to be *contradictory* or *unusual*.

➢ There are two different *types of data – qualitative and quantitative*.

  – *Qualitative data* deal with descriptions and data that can be *observed, but not measured*.

  – *Quantitative data* are data that can be *counted or measured* and the results can be recorded using numbers or represented visually in *graphs and charts*.

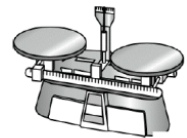| Qualitative	Quantitative
• Friendly • Like science • Positive about school	• 10 fourth-grade students and 12 fifth-grade students • 14 girls, 8 boys

➢ *Metric measures* are a standard way to make measurements recognized around the world.

Length - *millimeters*, *centimeters*, *meters*, *kilometers*
  – Instruments - *centimeter rulers, meter sticks*

Mass - *grams, kilograms*
  – Instruments – *balances, scales*

Volume (capacity) *- milliliters, liters*
  – Instruments – *graduated cylinders, beakers*

Balance
measures mass

Scale
measures weight

Temperature - *degrees Celsius*
  – Instruments – *Celsius thermometers*

Time – *minutes, hours, days*
  – Instruments – *stopwatches*

➢ *Estimation* is a useful tool for making *approximate measures* and giving general descriptions.

  ✓ make reasonable estimations of length, mass, volume, and elapsed time.

A *classification key* is an important tool used to help *identify rocks, minerals, and organisms*. It consists of a *branching set of choices* organized in levels, with most levels of the key having two choices. Each level provides more specific descriptors, eventually leading to identification.