Glossary of Scientific Method Words

Anomaly: An anomaly is an observation that differs from expectation or from accepted scientific views. Anomalies lead scientists to revise a hypothesis or theory.

Central Limit Theorem: The central limit theorem states that with a sufficiently large sample, the sampling distribution of the mean will be normally distributed. This normality is necessary to apply the t-test. If you plan to perform a statistical analysis of experimental data, it's important to have a large sample.

Conclusion: The conclusion is your determination of whether the hypothesis should be accepted or rejected. It is one of the key steps in the scientific method.

Control Group: The control group is the set of test subjects randomly assigned to not receive the experimental treatment. In other words, this group does not receive the independent variable.

Control Variable: A control variable is a factor kept constant during an experiment to ensure a fair test. It is also known as a constant variable.

Correlation: A correlation is a relationship between two variables that can be used to predict the behavior or value of one variable if the other is known. Correlation is not the same as causality. In other words, correlating two variables doesn't always imply one causes the other.

Data (singular: datum): Data refers to any facts, numbers, or values obtained in an experiment. Data may be quantitative (numbers) or qualitative (descriptions).

Data Table: A data table is a structured way to organize data from a science experiment. It typically includes columns for the independent and dependent variables.

Dependent Variable: The dependent variable is the variable that responds to the independent variable. It is the one that is measured in the experiment. It is also known as the responding variable or dependent measure.

Double-blind: In a double-blind experiment, neither the researcher nor the subject knows whether the subject is receiving the treatment or a placebo. "Blinding" helps reduce biased results.

Empty Control Group: An empty control group is a type of control group that does not receive any treatment, including a placebo.

Error: Error refers to the difference between a measured value and the true value. It may result from limitations in instruments, environmental factors, or human error.

Experiment: An experiment is a repeatable procedure that tests a hypothesis by manipulating variables and observing outcomes.

Experimental Group: The experimental group is the set of test subjects randomly assigned to receive the experimental treatment.

Extraneous Variable: Extraneous variables are additional variables (not the independent, dependent, or control variables) that may influence an experiment but are not accounted for or are beyond control. Examples include factors such as the manufacturer of the equipment or the color of materials used.

Fact: A fact is a statement based on evidence obtained from direct observation.

Graph: A graph is a visual representation of data, typically showing the relationship between variables. Common types include line graphs and bar graphs.

Hypothesis: A hypothesis is a testable prediction about the effect of the independent variable on the dependent variable.

Independence or Independently: Statistical independence means that one factor does not exert influence on another. For example, what one study participant does should not influence what another participant does. Independence is critical for meaningful statistical analysis.

Independent Random Assignment: Independent random assignment means randomly selecting whether a test subject will be in a treatment or control group.

Independent Variable: The independent variable is the variable that is manipulated or changed by the researcher. An experiment typically tests one independent variable at a time.

Independent Variable Levels: Independent variable levels refer to the different values assigned to the independent variable (e.g., different drug doses or durations of exposure). Each unique value is called a "level."

Inferential Statistics: Inferential statistics involve using data from a sample to draw conclusions or inferences about a population.

Internal Validity: Internal validity refers to the extent to which an experiment accurately demonstrates a causal relationship between the independent and dependent variables.

L**aw:** A scientific law is a generalization that describes what one expects to happen in a certain situation. For example, the law of gravity predicts an object will fall if dropped. Laws describe behavior but do not explain it.
Log Book: A log book or lab notebook records all of a scientist's observations, procedures, and results during an experiment. Entries are typically recorded in permanent ink.
Mean: The mean is the average, calculated by adding up all the scores and dividing by the number of scores.
Null Hypothesis: The null hypothesis is the "no difference" or "no effect" hypothesis. It predicts that the treatment will not have an effect on the subject. Null hypotheses are easier to evaluate using statistical analysis.
Null Results (Nonsignificant Results): Null results occur when the results do not disprove the null hypothesis. This does not prove the null hypothesis is true, as the findings may result from insufficient power. Some null results may reflect Type II errors.
Observation: An observation is information collected using one or more of the senses—sight, sound, touch, taste, or smell.
p < 0.05: This indicates the probability that the observed effect occurred by chance. A p-value of less than 0.05 means there's less than a 5% chance the observed difference happened randomly. Since this chance is small, the researcher may conclude the treatment had an effect. Other p-values may be used depending on the experiment.
Placebo (Placebo Treatment): A placebo is a fake treatment designed to have no effect outside of the power of suggestion. For example, a placebo pill may look identical to a real drug but contain no active ingredient.
Placebo Effect: The placebo effect is a beneficial response to a treatment due only to the subject's belief in the treatment's power—not from any actual properties of the treatment.
Population: A population is the entire group the researcher wants to study. If it's not possible to collect data from the whole population, data from a representative sample may be used to make inferences.
P**ower:** Statistical power is the probability of correctly rejecting a false null hypothesis. Higher power reduces the chance of making a Type II error.
Random or Randomness: Randomness refers to selection or behavior occurring without a predictable pattern or bias. Researchers often use coin flips, random number generators, or other chance-based methods to ensure fair sampling.
Results: Results are the outcome of an experiment, including both the data collected and the interpretation of that data.
Statistical Significance: Statistical significance means that a result is unlikely to have occurred by chance, as determined by a statistical test. A p-value (e.g., $p < 0.05$) is typically used to indicate significance.
Simple Experiment: A simple experiment is a basic setup used to assess a cause-and-effect relationship or test a prediction. It may involve only one subject or condition and does not necessarily include a control group.
Single-blind: In a single-blind condition, either the experimenter or the subject is unaware of whether the subject is receiving the treatment or a placebo. Blinding helps reduce bias in both behavior and data interpretation.
T-test: A t-test is a statistical method used to determine whether there is a significant difference between the means of two groups. It compares the size of the observed difference to the variability of the data. Generally, the greater the difference relative to the variability, the more likely it is that the result is statistically significant.
Theory: A theory is a well-supported and systematic explanation for a set of phenomena, based on repeated testing and observation. Theories may be refined or rejected if new evidence contradicts them.
Type I Error (Type 1 Error): A Type I error occurs when the null hypothesis is rejected, even though it is actually true. For example, you might conclude that a treatment works when it really doesn't.
Type II Error (Type 2 Error): A Type II error occurs when the null hypothesis is accepted, even though it is false. In this case, the experiment fails to detect a real effect.