

## INTRODUCTION TO EXPERIMENT DESIGN

**1.1- Experiments** are structured ways to test ideas. They test one factor at a time while controlling others

**Definition:** Framework for collecting data, controlling variables, and analyzing outcomes

**Importance:** Ensures reliability, minimizes bias, allows causal inference

### 1.2- Properties of Well-Designed Studies:

Every good study must contain an integrated experiment design that contains all the conditions that are internationally recognized in writing research so without these things, the experiment is considered weak. There are many types of experiments and each experiment will be different from the other in its partial details depending on the specialty of each.

**1.3- Variables:** are the factors in an experiment that can change or be changed.

**Independent Variable (IV):** It is the variable that is varied or manipulated by the researcher (**Factor you change**) (e.g., fertilizer amount)

**Dependent Variable (DV): (What you measure)** A dependent variable is what happens as a result of the independent variable (e.g., plant height)

**Controlled Variables:** Factors kept the same (e.g., sunlight, water)

- This is the most important part of a fair test! You must keep everything else identical so you **know any change in the DV is caused only by the IV**.

## 1.4 Groups

You need to compare your results to something. That's why we have groups.

**Experimental Group:** The group that is exposed to the independent variable.

**Control Group:** The group that is NOT exposed to the independent variable. It serves as the baseline for comparison.

**Why is a control group so important? Without it, we wouldn't know if the test scores were due to the factor changes (IV) or just because of what I measured (DV). The control group "controls" for all the other factors.**

## 1.5 Hypothesis

A hypothesis is not just a guess. It's an educated prediction. **It's a clear, testable statement that often follows an "If... then... because..." format.**

**Format: IF [I change the Independent Variable], THEN [the Dependent Variable will change in a specific way], BECAUSE [a scientific reason].**

**Not:**

- **Control Group:** No treatment, used for comparison
- **Experimental Group:** Gets the treatment
- **Randomization:** Reduces bias
- **Replication:** Ensures reliability

**Question: Does study in the garden improve test scores for student?**

Component	Our Example
Hypothesis	If students sit in the garden while studying, then they will get higher test scores.
Independent Variable	Presence of garden for study (Yes / No)
Dependent Variable	Score on the test (0-100%)
Control Group	Studies in classroom
Experimental Group	Studies in garden
Constants	Same test, same study time, same room, same teacher, same topic

## 1.6 Avoiding bias when conducting your experiment:

**Bias the action of supporting or opposing a particular person or thing in an unfair way, because of allowing personal opinions to influence your judgment**

The bias is to show that your -or the same- results are better than those of other researchers or that you do not cite the opposite results for yours. The bias may be when you care about the treatment group that you hope to give the results you want, not the actual results and ignore the control group

How can we reduce bias?

1. **Control group**
2. **Blinding**
3. **Randomize the groups**

control group or in any of the experimental group(s).