

UNDERSTANDING VARIABLES

Using the Scientific Method

Types of Variables

Independent

The one thing you change.
Limit to only one in an experiment.

Example:
The liquid used to water each plant.

Independent Variable



Dependent

The change that happens because of the independent variable.

Example:
The height or health of the plant.

Dependent Variable



Controlled

Everything you want to remain constant and unchanging.

Example:
Type of plant used, pot size, amount of liquid, soil type, etc.

Controlled Variables



DESIGNING AN EXPERIMENT

STEP 1: DEVELOPING A QUESTION

- Start by coming up with a guiding question .
- Remember, you must be able to answer the question using an experiment.


Our Question:

How does the liquid used to “water” a plant affect the rate of plant growth?


Next: Manipulating Variables

VARIABLES

A variable is any factor, trait, or condition that has the potential to vary in type or amount in different systems.



In other words, variables are the factors that change during an experiment or scientific investigation.



Variables come in three varieties:
**CONSTANT, INDEPENDENT, and
DEPENDENT,**



CONSTANTS (AKA CONTROLLED VARIABLES)

- A constant, sometimes referred to as a controlled variable, is a factor you must intentionally keep the same for the duration of the experiment.
- Failure to effectively control the constants will yield inaccurate/unreliable test results.

What factors should be constants in our plant experiment?

THE NEGATIVE EFFECTS OF UNCONTROLLED CONSTANTS

- In our experiment, we will “water” each plant with a different liquid in order to determine if the liquid used will impact the plants’ growth rate.
- At Stein Gardens and Gifts there was a sale on potted perennials and we purchased these 4 plants for our project.
- What could go wrong?



KEEP IT CONSTANT

Using 4 different plants will yield unreliable results because we can't be 100% sure any difference in growth rate is completely due to the type of liquid used to water the plant. The yellow plant might naturally grow faster than the pink one regardless of the liquid used.

Ideally, you should use the same type of plant for all testing.



2.

INDEPENDENT VARIABLES

- The independent variable is **the factor you PURPOSELY change** in order to see its affect on a system and compare results.
- There can only be ONE independent variable in an experiment.

*The independent variable is the “if” part of your hypothesis.

What is the independent variable in our plant experiment?

WHY IS IT UNWISE TO HAVE MULTIPLE INDEPENDENT VARIABLES?

- Our independent variable is the type of liquid we used to water the plants.
- What if we changed both the type of liquid AND the type of plant?



3.

DEPENDENT VARIABLES

- The dependent variable is the factor that is observed and measured for data collection.
- Dependent variables change due to the impact of the independent variable (They **DEPEND** on the other variables).
- measuring dependent variables will create your results.
- *The dependent variable is the “then” part of your hypothesis.

What is the dependent variable in our plant experiment?

MEASURING DEPENDENT VARIABLES

- In order to collect data from an experiment, you must be able to **quantify** the dependent variable.
- If measuring, use the metric system. If using a survey or other assessment, be sure there are measurable scores (%).
- Put the data in a table, graph, or chart, and use it as the data section of your lab report.



CONTROL GROUPS

- A Control Group is a test subject(s) separated from the rest of the experiment. The control subjects have no special testing performed on them and are free from the impact of the independent variable.
- Often, control groups represent what is normal or ordinary in a given scenario and help experimenters determine the true impact of the independent variable.

Is there a control group in our plant experiment?

WHAT ABOUT A REGULAR PLANT?

If we use just regular water to “water” one of the plants, it would be the control group.

We could also have a plant that we don’t “water” at all as the control group but it may not give us much insight into the experimental question.

Note that not every experiment needs a control group.



IN REVIEW

01

Constant Variables:
Factors purposely
kept the same
throughout the
experiment

02

Independent Variable:
The ONE factor
purposely changed in
order to see its affect
on the test subject(s)

03

Dependent Variable:
the measurable,
quantifiable factor
that will create the
data and results of
the experiment

Control Groups: Test subjects that are separated from the rest of the experiment and represent what is typical for a given situation. Use only when needed.