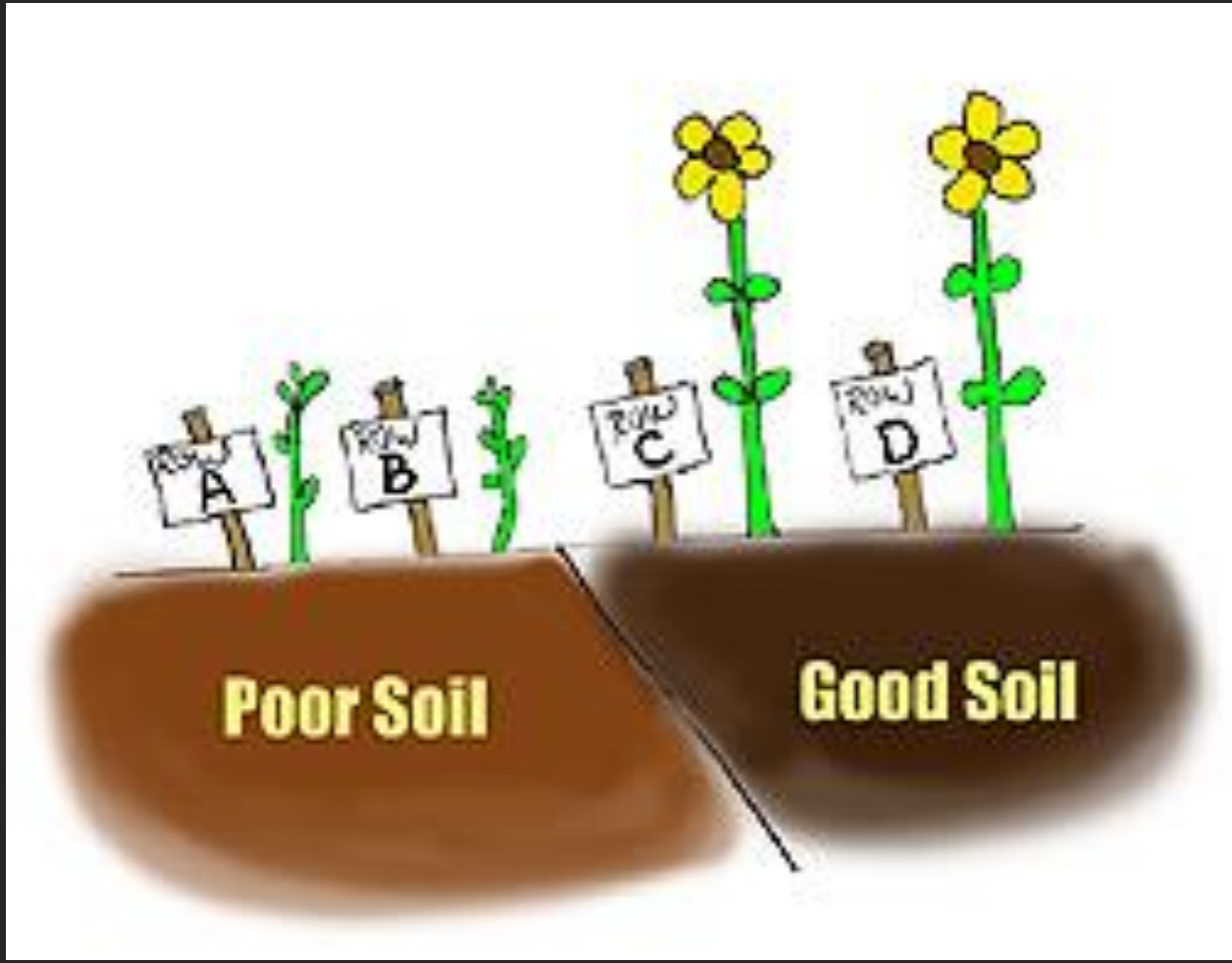
Variables

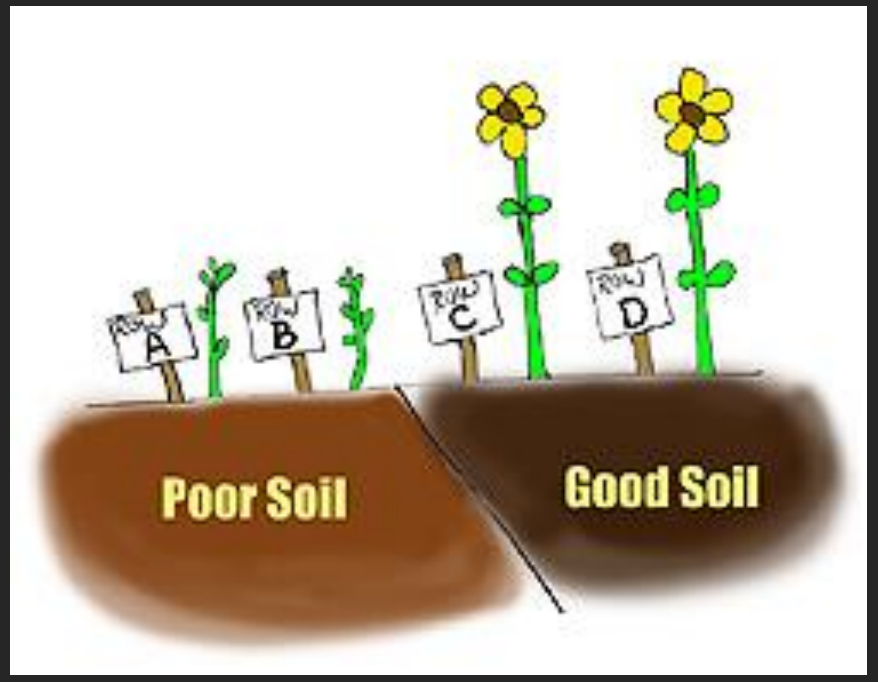
How do we design a fair experiment?

Describe this experiment



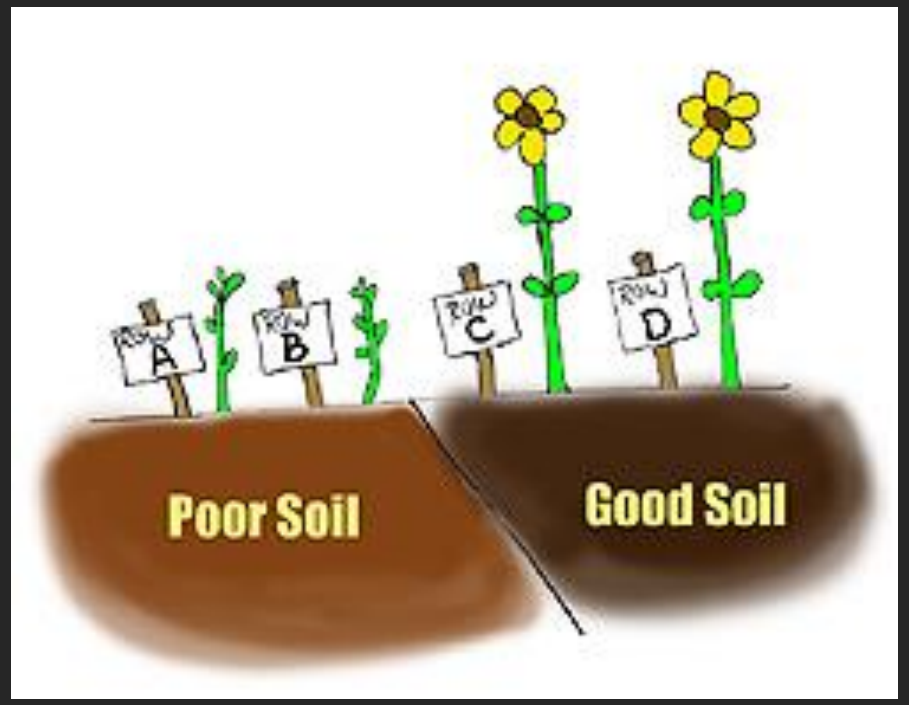
Hypothesis:

IF we plant flowers in different soil,
THEN the flowers planted in good soil will grow taller



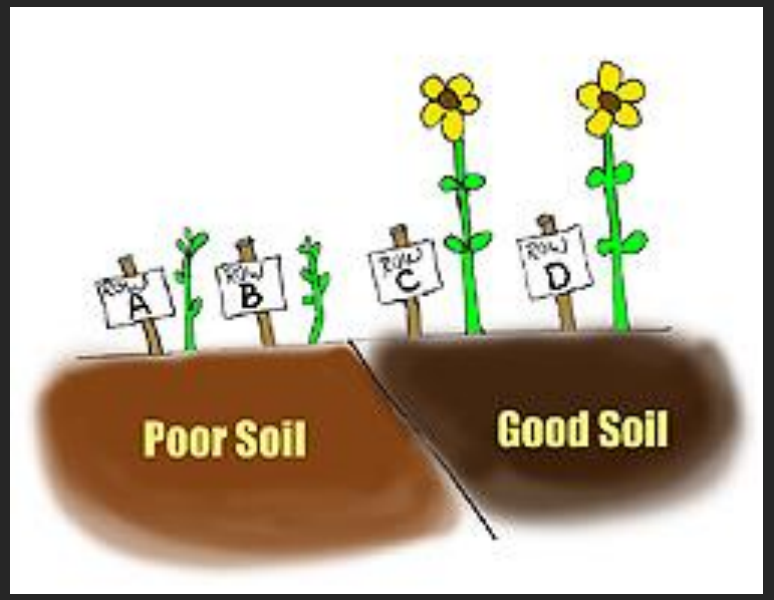
Variables

- Scientists design variables in order to look for cause and effect relationships (how changes to one thing cause changes in something else)
- These changing things are called variables.
- To make an experiment fair, we have to design our variables correctly
- There are 3 types of variables:
  - Independent variable
  - Dependent variable
  - Controlled variables



Independent Variable "The Cause"

- The variable that the scientist changes on purpose, to see what happens
- What you are testing
- As you change the independent variable, you observe to see what happens or results from that change.
- A good experiment will have only ONE independent variable, in order to ensure valid results
- What is the independent variable in this experiment?

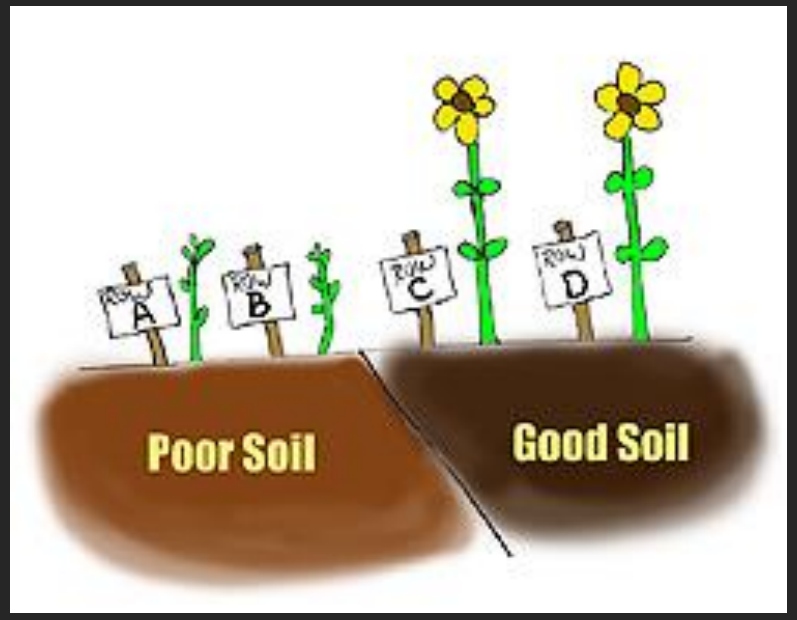


Independent Variable "The Cause"

- The independent variable will be the "IF" part of the hypothesis

IF we plant flowers in different types of soil,

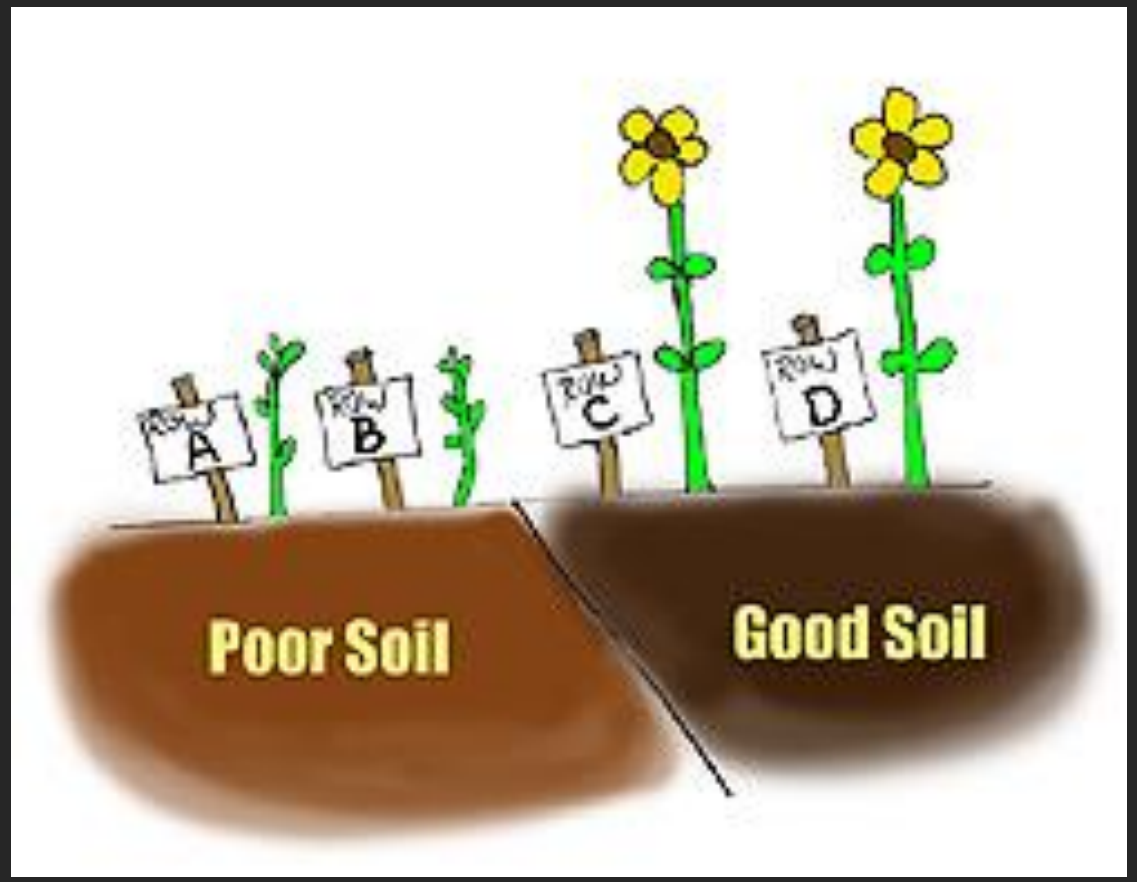
THEN the flowers planted in good soil will grow taller.



- Look at the "IF" statement. You are testing different types of soil to see what happens. So, the type of soil is the INDEPENDENT variable.

Dependent Variable "The Effect"

- Something that might (or might not) be affected by the independent variable.
- What you are measuring or observing.
- The data you are collecting.
- You are looking for a response to the changes made in the independent variable.
- What is the dependent variable in this experiment?



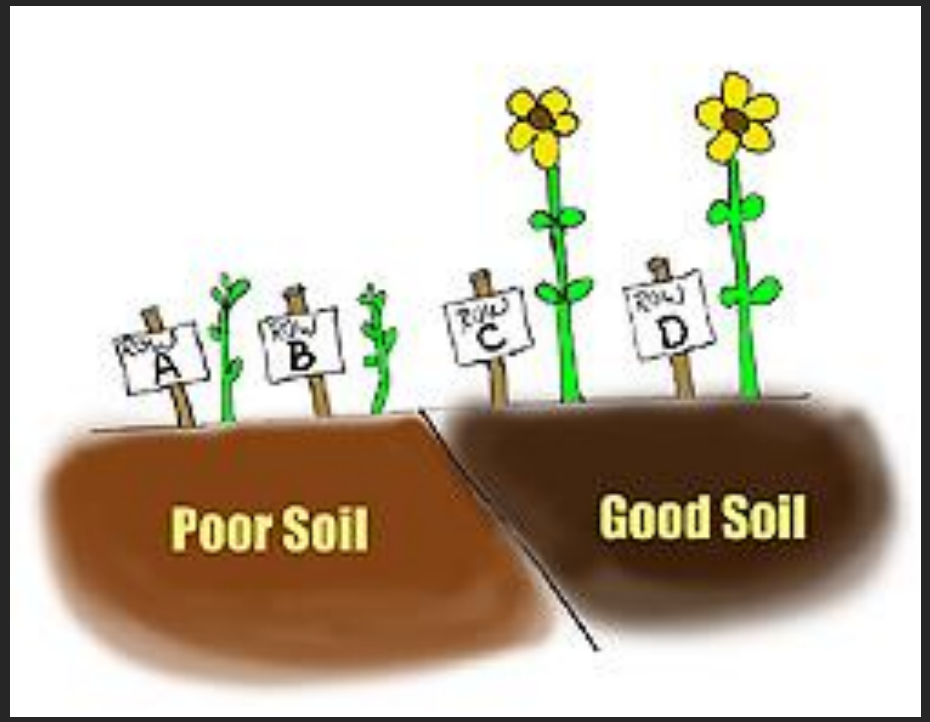
Dependent Variable "The Effect"

- The dependent variable will be the "THEN" part of the hypothesis

IF we plant flowers in different types of soil,

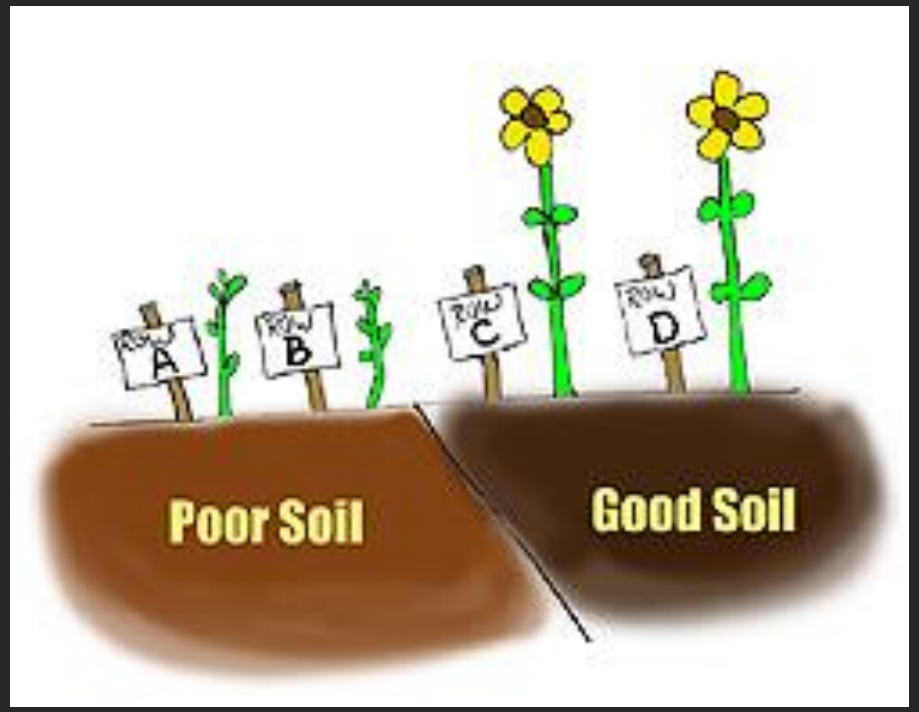
THEN the flowers planted in good soil will **grow taller**.

- Look at the "THEN" statement. You are measuring plant growth. So, plant growth is the DEPENDENT variable.



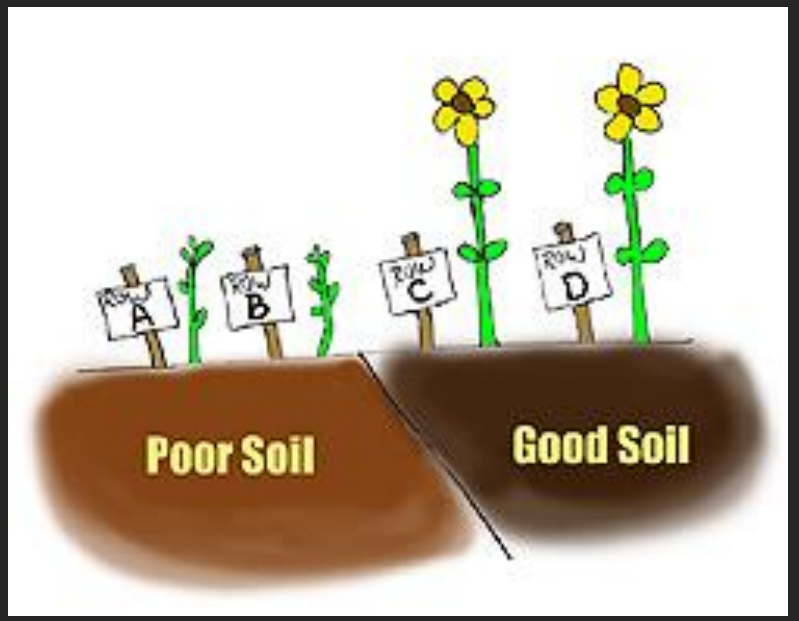
Controlled Variables

- Things that *could*, but should NOT be changed.
- Also called constants.
- Keep the controlled variables the same for all tests!
- This allows for a fair test.
- Better controls = more likely your results will be valid.
- What do we need to keep constant in this experiment?



Let's Take Notes

- Independent (Manipulated) Variable
  - Only ONE.
  - What you are testing (the cause)
  - The "IF" part of the hypothesis
- Dependent (Response) Variable –
  - What you are measuring or observing / the data you are collecting
  - The results (the effect)
  - The "THEN" part of the hypothesis
- Controlled (Constant) Variable –
  - Keep all other variables the same
  - Makes the experiment fair.



Remember!

The Independent Variable CAUSES the Dependent Variable

Let's Practice!

- Students of different ages were given the same jigsaw puzzle to put together. They were timed to see how long it took to finish the puzzle.
- The hypothesis was: IF different ages of students work a jigsaw puzzle, THEN the older students will be able to finish it faster.

The _____ CAUSES the _____
(independent variable) (dependent variable)

Identify the variables in this investigation.

What was the independent variable?

What was the independent variable?

- Ages of the students
  - Different ages were tested by the scientist
  - The scientist got to choose which ages to test
  - The "IF" part of the hypothesis

What was the dependent variable?

What was the dependent variable?

- The time it to put the puzzle together
  - The time was measured by the scientist
  - The scientist wanted to see if the puzzle time "depended" on the age of the students
  - The "THEN" part of the hypothesis

Name one controlled (constant) variable

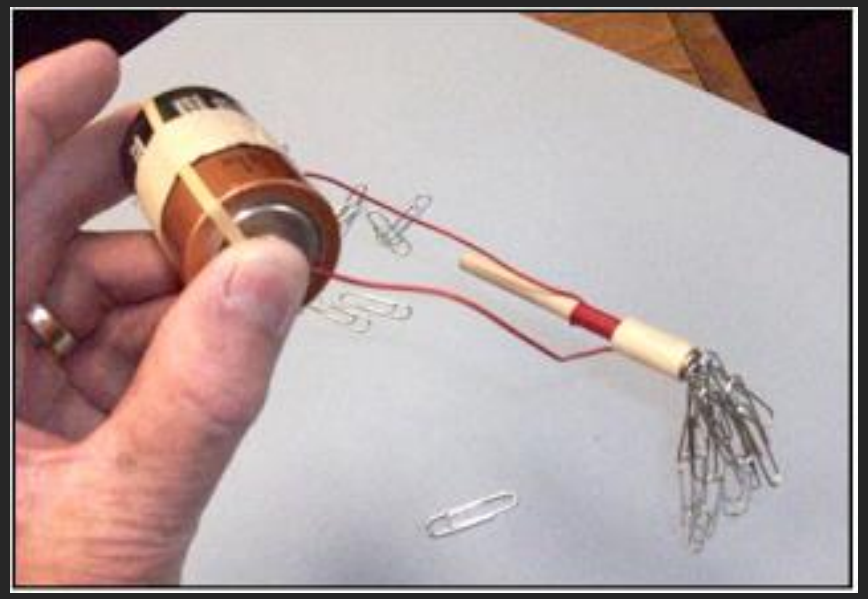
Name one controlled (constant) variable

- Same puzzle
  - All of the participants were tested with the same puzzle.
  - It would not have been a fair test if some had an easy 30 piece puzzle and some had a harder 500 piece puzzle.

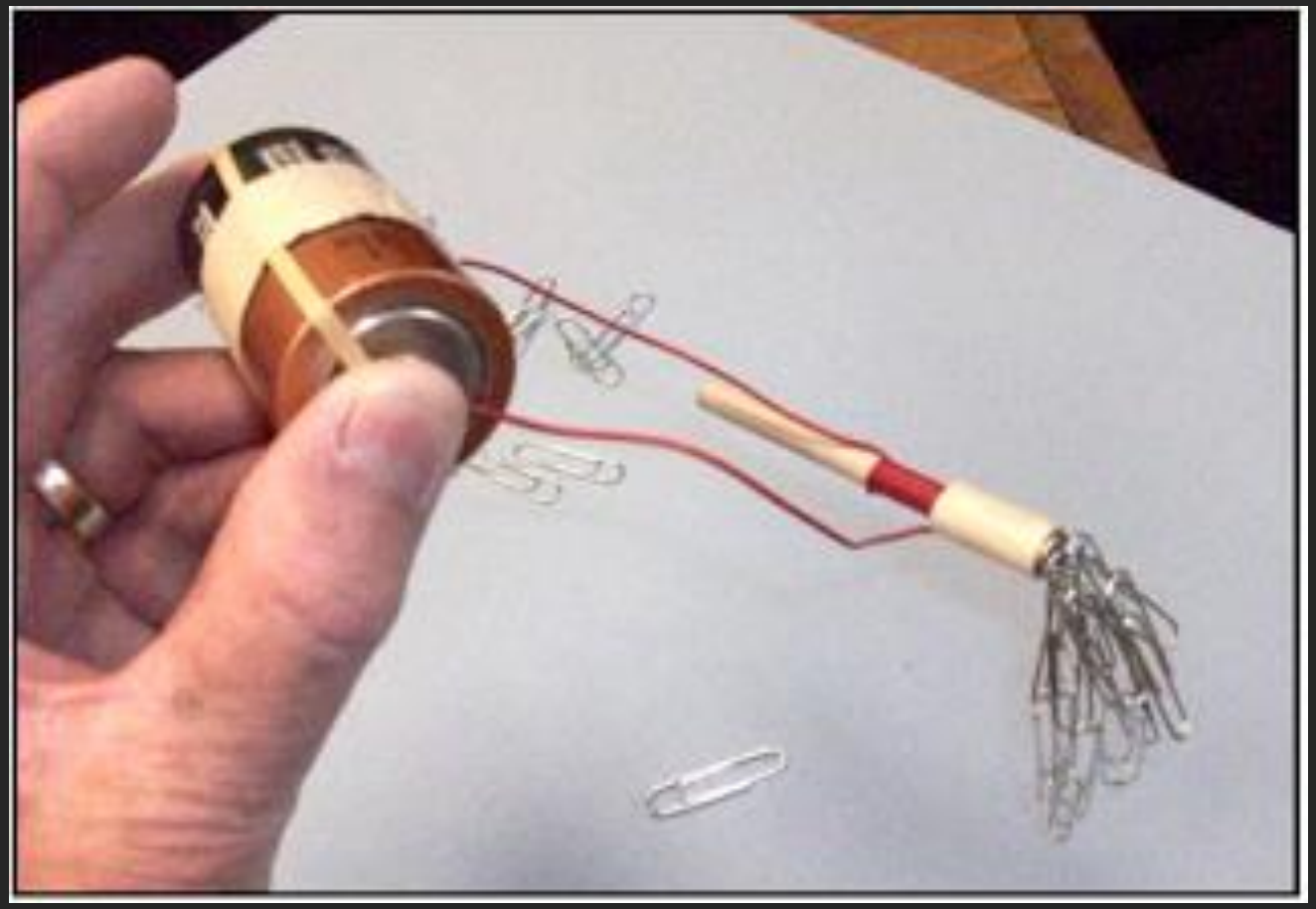
Let's Practice!

- An investigation was done with an electromagnet made from a battery and wire wrapped around a nail.
- Different sizes of nails were used.
- The scientist measured the number of paper clips each size nail could pick up.

The _____ CAUSES the _____
(independent variable) (dependent variable)

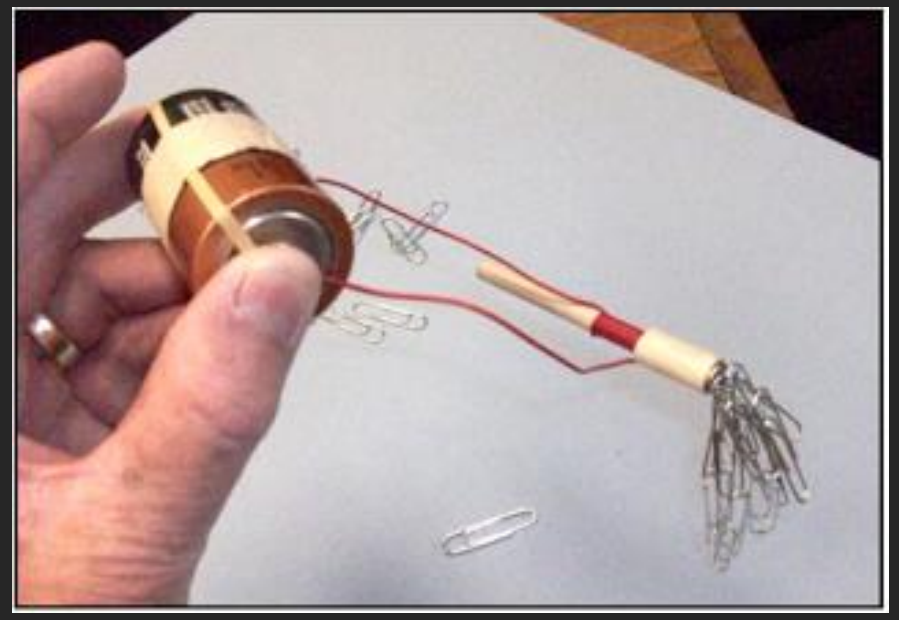


What was the independent variable?

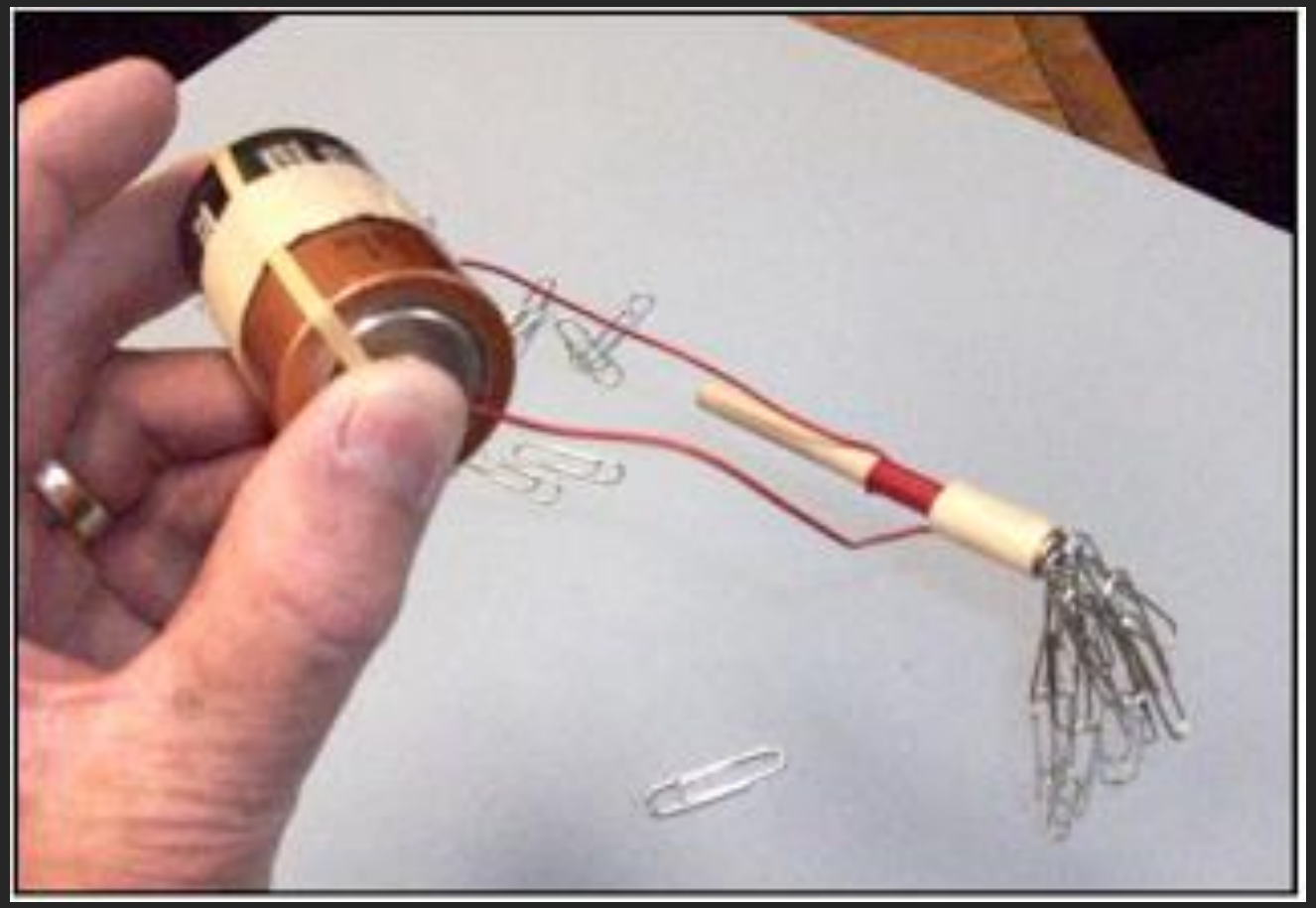


Independent variable

- Size of nails
  - The scientist was testing different sized nails
  - The scientist got to choose which size nails to use

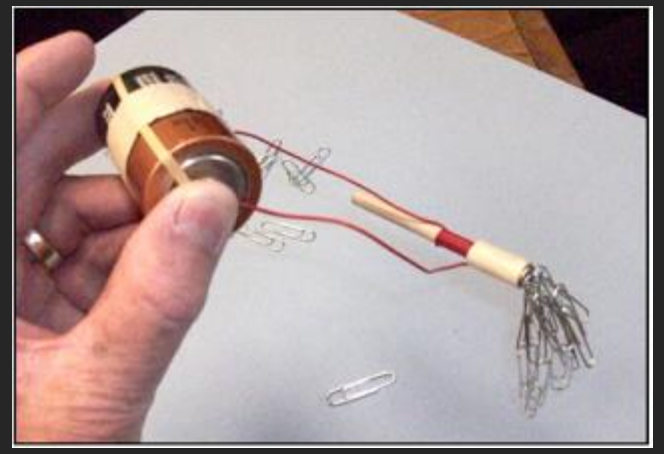


What was the dependent variable?

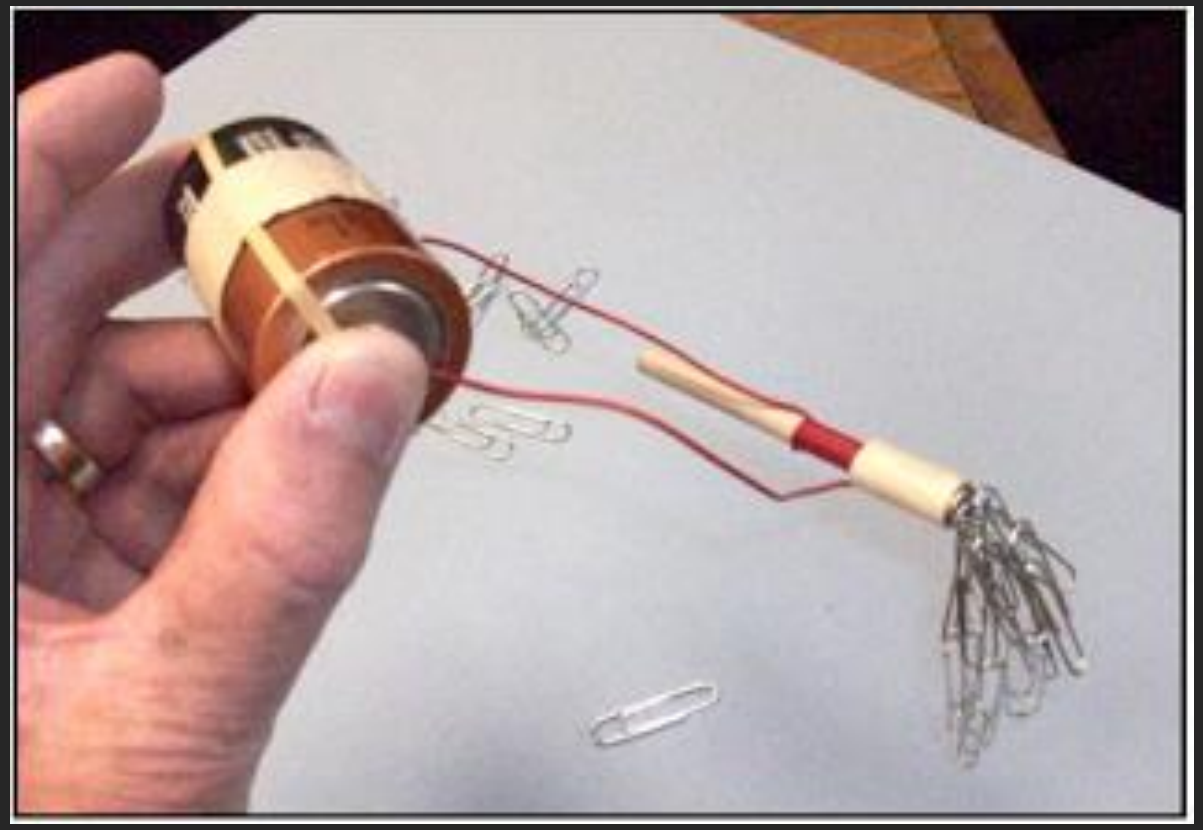


Dependent variable:

- Number of paper clips picked up
  - That's what was being measured (counted)



What variables needed to be controlled (kept the same)?



Controlled variables:

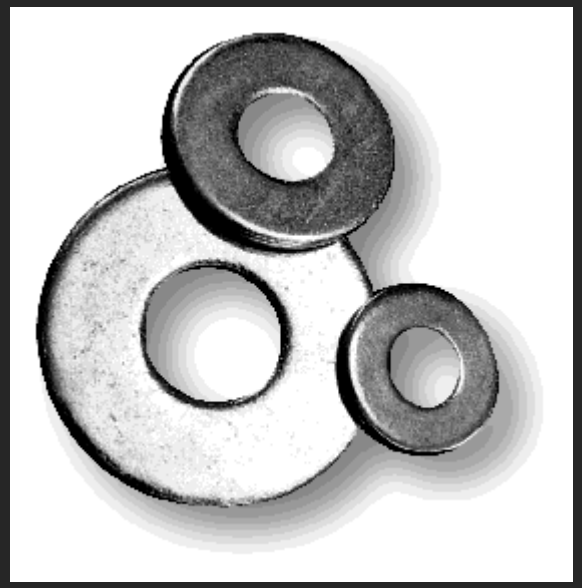
- Battery size/strength, type/size of wire, type of nail, size of paper clips
  - None of these items were changed during the experiment

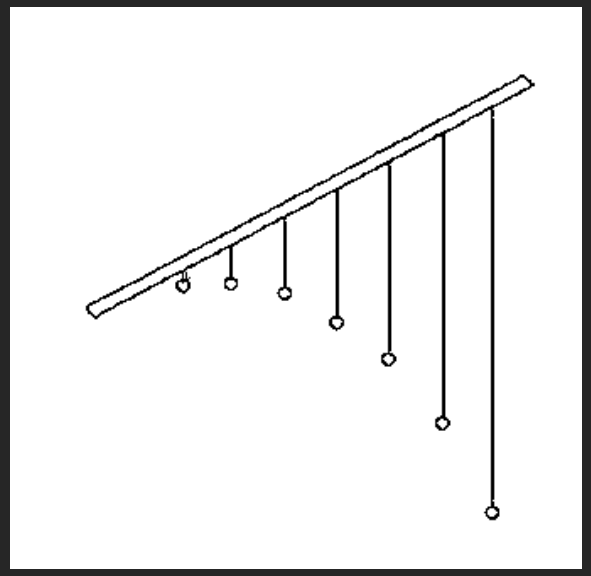
Pendulum Experiment

- Where did we go wrong in our first pendulum experiment?

Pendulum Experiment

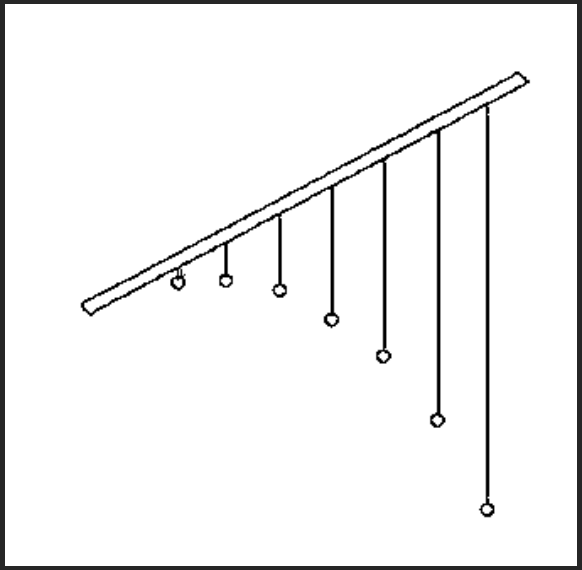
- We had too many independent variables.
- You should only have ONE.
- We had TWO – length of string and weight of pendulum





Pendulum Experiment

- Let's try again! This time, we'll make the experiment fair.
- We'll have only ONE independent variable: the length of the string.



Here we go!

- We will do 3 trials.
- We will use the MEDIAN number. (Why???)
- Let's practice swinging and counting!

Analyze Data - Bar Graph

- Parts of a bar graph:
- Title
- Label x-axis
- X-axis: independent variable (bars)
- Label y-axis
- Y-axis: dependent variable (numbers)
- Decide on intervals

Analyze Data - Line Graph

- Parts of a line graph:
- Title
- Label x-axis
- X-axis: independent variable (length of string)
- Label y-axis
- Y-axis: dependent variable (number of swings)
- Decide on intervals

Analyze Data

- What do you notice?
- Do you see a pattern? Explain.
- A pattern usually tells you there is a connection between the independent variable and the dependent variable.

Conclusion

- The conclusion answers the question.
- The question was "How does the length of the string affect the number of swings?"
- Do we have the answer to the question?
- Write your conclusion

CONCLUSION: The longer the string,
the _____ number of swings.