

EXPERIMENTAL DESIGN AND THE SCIENTIFIC METHOD



On Oct. 23, 1927, three days after its invention, the first rubber band is tested.

I. The Scientific Method Steps

1. Observe and state the problem
2. Form a hypothesis
3. Test the hypothesis by conducting an experiment
4. Record and analyze the data
5. Form a conclusion
6. Replicate the work

II. Example

1. Turn on flashlight; nothing happens.
2. Form a hypothesis.
3. Change the batteries.
4. Test the hypothesis.
5. Nothing happens.
6. Analyze the data.
7. Reach a conclusion.
8. Didn't work, so form a new hypothesis.



9. Change the light bulb.
10. Test the hypothesis.
11. Flashlight works!
12. Reach a conclusion.



III. Experimental Must Knows

1. Scientists use an experiment to search for a *cause and effect* relationship

2. Variables =

the changing quantities

any factor, trait, or condition that

can exist in different amounts or types



IV. Variables

Four Variables

1. Independent
2. Dependent
3. Control
4. Constant

1. Independent Variable

- a. The variable that is changed by the scientist
- b. A good test/experiment has only

1

independent variable

“WHAT I CHANGE!”



2. Dependent Variable

- a. The dependent variable *responds* to the change made in the independent
- b. The dependent variable is *caused by & depends on* the independent
- c. An experiment can have more than one dependent variable

“WHAT I OBSERVE!”

3. Controlled Variable

- a. Quantities and conditions that scientists **want to keep “normal,” as if the experiment hadn’t occurred.**

(and they must observe them as carefully as the dependent variable)

- b. A control is used to compare to the independent variable



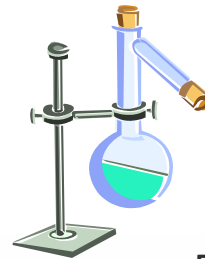
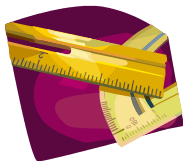
(to see if the change the scientist made worked)

“WHAT I KEEP NORMAL!”

4. Constant(s)

- a. A constant is something that doesn't change between **ANY** of the variables.
- b. The constants are the same for all parts in the experiment.
- c. Time, Amounts, Equipment, Procedure

“WHAT I KEEP THE SAME!”



V. Hypothesis

HYPOTHESIS

1. MUST be an **IF, THEN** statement
IF _____, THEN _____.

IF = independent variable (the cause)
THEN = dependent variable (the effect)

Examples

- a. **IF** mice are fed a growth-inhibiting hormone, **THEN** they will not be able to run a maze.

- b. **IF** hamburger meat is placed under UV light, **THEN** the meat will have less bacteria on it.

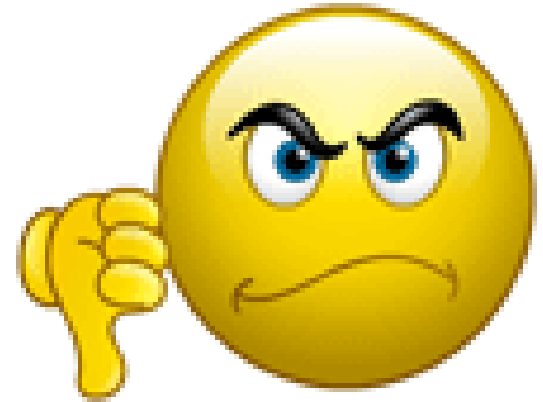
VI. Conclusion

1. Should always tell whether the scientist



ACCEPTS

or



REJECTS

the hypothesis and ***WHY***.

VII. Measurable

1. In good experiments scientists must be able to *measure the values for each variable.*

a. Good example:

weight or mass - very measurable

b. Bad example:

love - not measurable

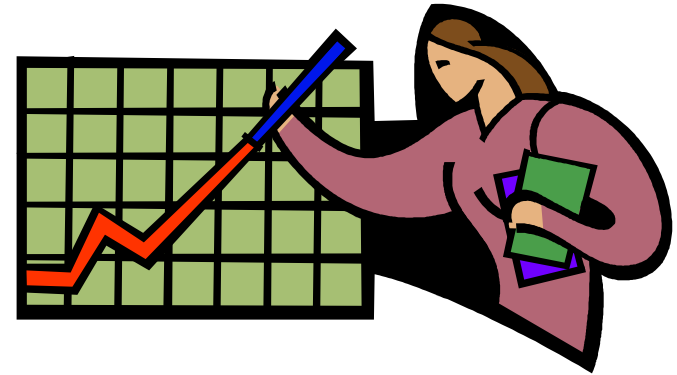
(what do you use, a love-o-meter?)



VIII. Graphing the Variables

1. Independent Variable = X Axis

2. Dependent Variable = Y Axis



If time is one of the variables, then time is almost always independent! (and is therefore graphed on the X Axis!)

