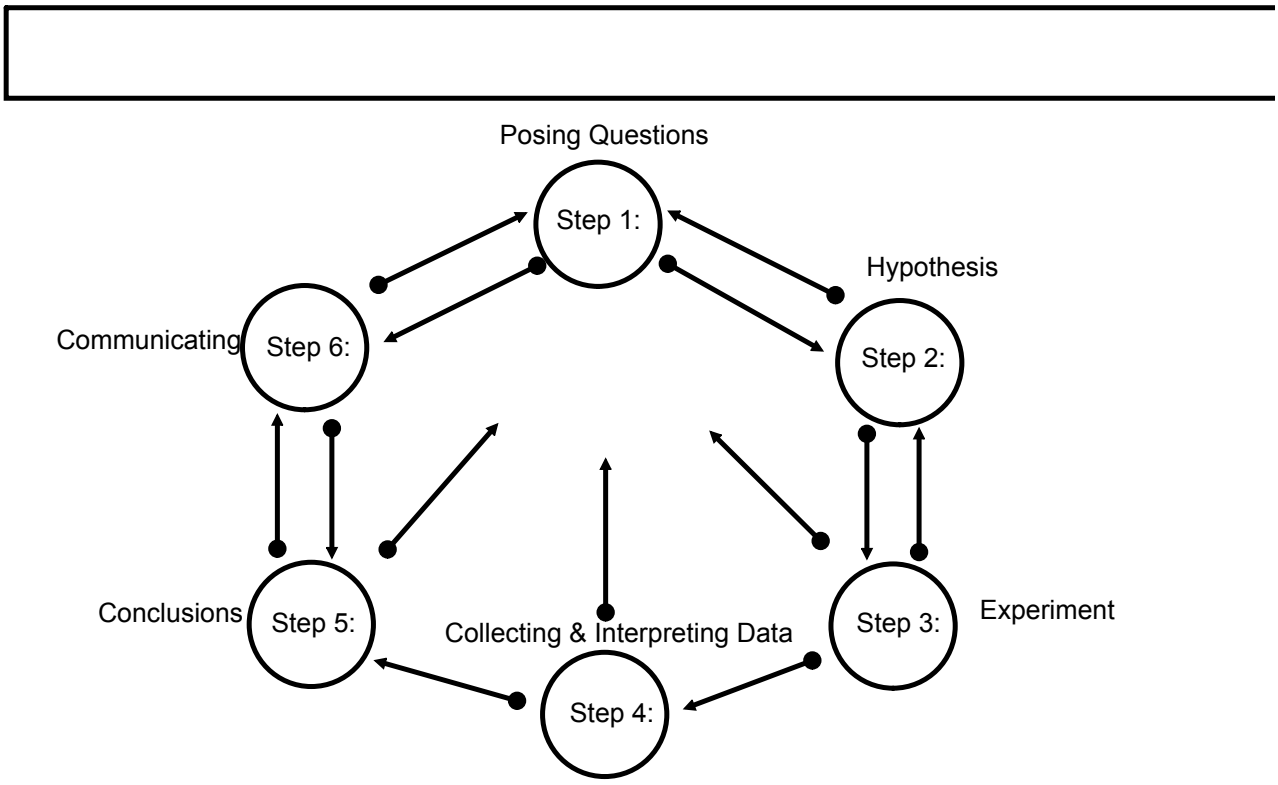
Lecture: Scientific Inquiry
9/23

ıat does it mean to "Think like a Scienst?"

a. Siensts seek to understand the world by using observing, inferring, and predicng. The way they think is also important, such as their atude or habits.

1. Observing: using your senses to gather info.
2. Inferring: explaining what you observe
3. Predicng: forecast based on evidence
4. Scienfic Atudes: curiosity, honesty, skepcism, creavity, and open-mindedness,

Put the vocabulary terms in the proper order.



Scientific Inquiry Steps

1. **Posing Questions:** problem or question based on observations
    a. Observation: tall people play basketball
    b. Question: Are taller people better at basketball?

2. **Developing a Hypothesis:** possible explanation for observations or answer to a scientific question
    a. NOT A GUESS- It's a statement/answer/explanation/period
    b. Answer to "Posing Question"
        i. Based on observations
    c. It MUST be testable (i.e., falsifiable)
    d. Anecdotal
        i. Observation: tall people play basketball
        ii. Hypothesis: Above average height people are better at shooting a basketball.

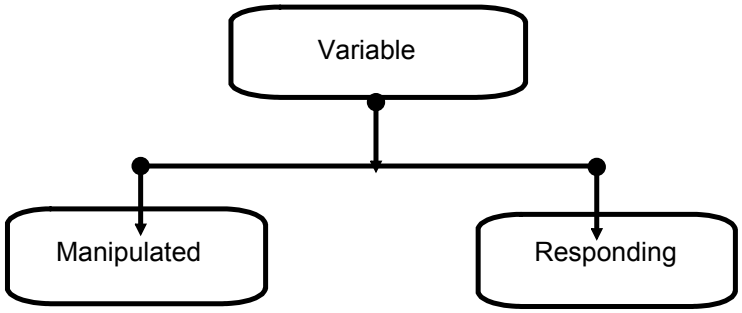
Scientific Inquiry Steps

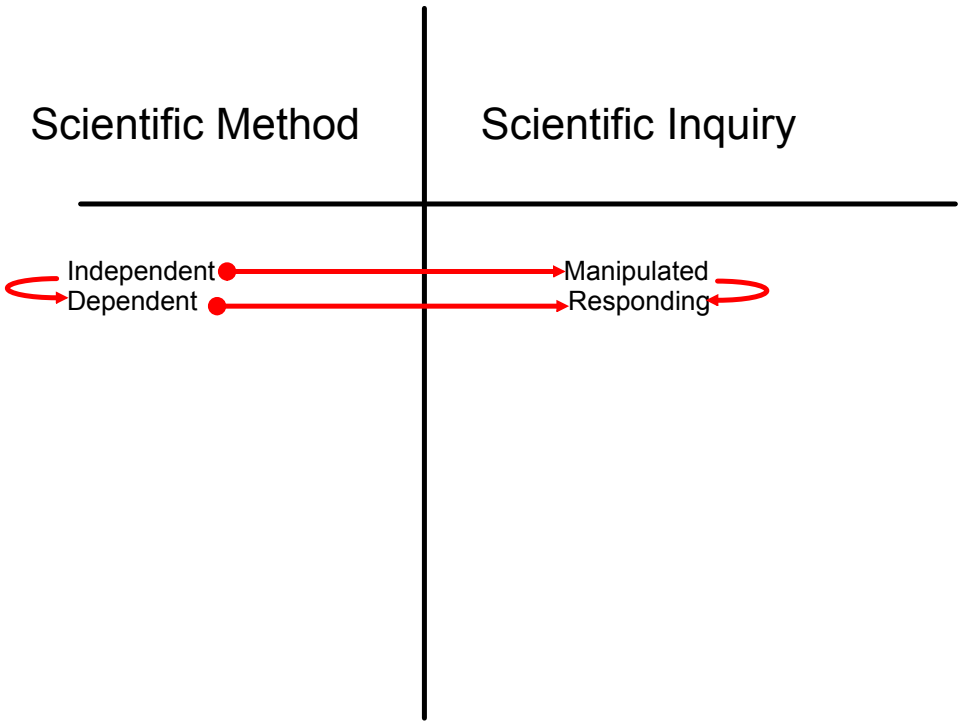
3. Designing an Experiment: testing the hypothesis

a. Controlled Experiment:

i. Variable:

> Manipulated Variable: scientist changes
  – Cause, factor
    « e.g., above & below average height people
> Responding Variable: result of changes
  – Effect, outcome
    « e.g., ability to shoot basketball




Scientific Method
Scientific Inquiry
Independent
Dependent
Manipulated
Responding

Scientific Inquiry Steps

4. Collecting and Interpreting Data: data collection in units and thinking/summarize

e.g., data table; average data points

5. Drawing Conclusions: prove/disprove hypo.; predicting; generalizing

6. Communicating: report to public

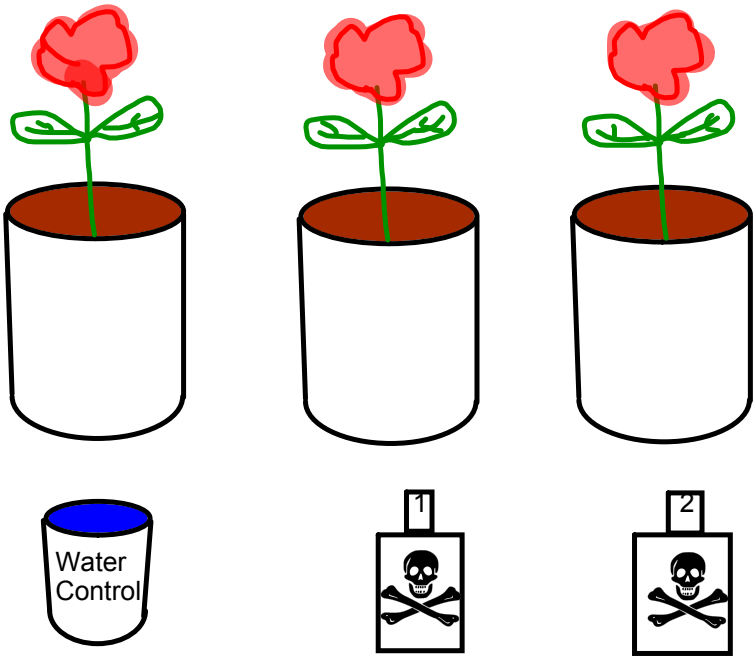
Below Average Height Shots Made	Above Average Height Shots Made
5/5 2/5 2/5 1/5	3/5 4/5 3/5 2/5
50% Accuracy	60% Accuracy

Can we generalize our finding to the public and say it is universally true that taller people are better shots?

Scienfic Inquiry Vocabulary

1. Hypothesis: explanaon/answer for our queson we posed (statement)
2. Variable: item that changes in experiment
3. Extraneous variable (constant/controlled variable): item you keep the same
4. Manipulated variable: you change to test hypothesis
5. Responding variable: outcome/result (manipulated variable causes this)
6. Scienfic Control: known comparison
7. Cohort: group of subjects with a similar trait (i.e., tall)
8. Placebo: false belief (e.g., get water but think it makes you smarter)
9. Falsifiability: hypothesis can be proven wrong

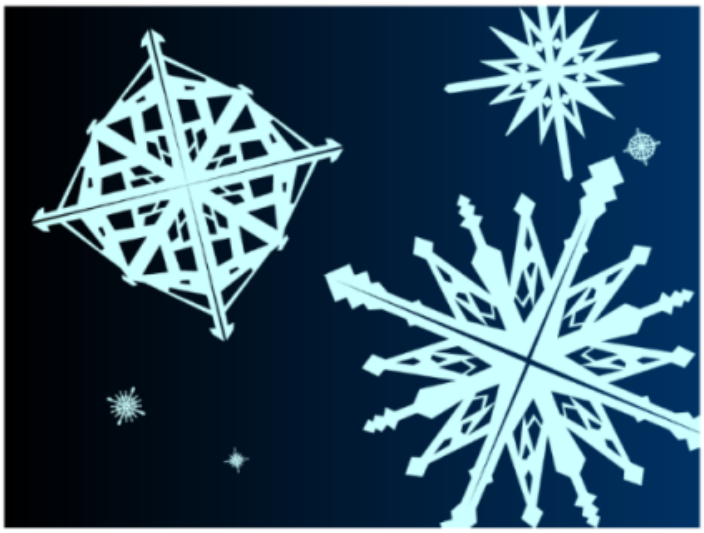
Which pesticide kills flowers?



BrainPOP FYI

SCIENCE > SCIENTIFIC INQUIRY > SCIENTIFIC METHOD

THEORY



The scientific method isn't just used to prove hypotheses correct. In fact, it is just as useful when it proves them wrong!

Something called **falsifiability** is the idea that a hypothesis has the ability to be proven false. Many scientists and philosophers believe that for an idea to be truly scientific, it has to be falsifiable—that is, it must be able to be proven wrong.

For instance, the statement "no two snowflakes have the same shape" is unfalsifiable because it would be impossible for scientists to collect all the snowflakes that have ever fallen and compare them to find out whether there are any matches. The statement "all snowflakes have the same shape" *is* falsifiable, since all you would have to do to prove it wrong is find two snowflakes with different shapes.

The idea of falsifiability has been very important to the logic of scientific experimentation—

Measurement Lecture

1) **Sample Size:** the number of tests or subjects in the experiment

2) **Sampling Error:** Too few subjects or observaons invalidang results of experiment

3) **Generalizing:** saying research is true of the enre populaon; need large enough sample size

4) **Averaging:** in order to get an accurate measurement siensts average mulple data points.

a. data points divided by total size

i. What you measure / Total possible = Average

.75 or 75%

e.g., 100 75

U-Draw
Practice diagramming hypotheses

http://www.execulink.com/~ekimmel/udraw_variables.htm

BrainPOP

Need extra help, games, or further information on scientific method?

http://www.brainpop.com/science/scientificinquiry/scientificmethod/

Username: dundeeschools

Password: Vikings101

Scientific Inquiry Websites

http://www.s-cool.co.uk/a-level/psychology/research-methods/revise-it/experiments

http://explorable.com/experimental-research

S.I. Diagramming

A scientist is testing tomato plants to see if they grow faster when classical music is played. In her experiment she has 10 plants listening to classical music and 10 plants listening to no music at all. What are the manipulated, responding, extraneous variable, and control?

a. Manipulated = plants, responding = music, extraneous variable =classical, control = scientist

b. Manipulated = music, responding = growth, extraneous variable =tomato plants, control = no music

c. Manipulated = tomato plants, responding = classical music, extraneous variable = no music, control = 10 plants

d. Manipulated = music, responding = growth, extraneous variable = classical music, control = 10 plants

S.I. Diagramming

A scientific study showed that the depth at which algae were found in a lake varied from day to day. On clear days, the algae were found as much as 6 meters below the surface of the water but were only 1 meter below the surface on cloudy days. Which hypothesis best explains these observations?

a. Nitrogen concentration affects the depth of algae.

b. Precipitation affects the depth of algae.

c. Light intensity affects the depth of algae.

d. Wind currents affect the depth of algae.

Based on the above observations and your understanding of photosynthesis, what hypothesis could you make about algae growth?

S.I. Diagramming

A student decides to set up an experiment to see if detergent affects the growth of seeds. He sets up 10 seed pots. Five of the seed pots will receive a small amount of detergent in the soil and will be placed in the sun. The other 5 seed pots will not receive detergent and will be placed in the shade. All 10 seed pots will receive the same amount of water, the same soil, the same number of seeds, and the same type of seeds. He grows the seeds for two months and charts the growth every 2 days.

What is wrong with his experiment?

a. More than one variable is being tested. (confounding variable)

b. The student should have a larger number of pots.

c. There is no way of measuring the outcome.

d. There is no control.

MythBusters

BrainPOP FYI

SCIENCE > SCIENTIFIC INQUIRY > SCIENTIFIC METHOD