Post-It Note on the Board: What is one practice or product that we use in agriculture today that resulted from research or science?

United States Department of Agriculture Research, Education and Economics (REE) Action Plan that "as the 21st century unfolds, America faces economic, social, and environmental challenges that require strong and innovative systems of food and agricultural science for answers and technology solutions" (United States Department of Agriculture [USDA], 2012).

One of the REE's goals presented in their action plan is to "recruit, cultivate, and develop the next generation of scientists, leaders, and a highly-skilled workforce for food, agriculture, natural resources, forestry, and environmental systems, and life sciences to out-educate our global competitors" (USDA, 2012).

United States Department of Agriculture Research, Education and Economics. (2012, February). *Research, education, and economics action plan*. Retrieved from http://www.usda.gov/documents/usda-ree-science-action-plan.pdf

"DuPont Agriculture offerings brings innovative science and solutions to meet the challenges faced by farmers today and into the future. In agriculture, succeeding for our customers means growing a healthy, marketable and profitable crop. For DuPont, it means something bigger: feeding the world sustainably. Our mission is to deliver agricultural products from seeds to crop protection to deliver higher crop yields and more nutrition foods. We believe that by working together with our customers, we can find better ways to improve quantity, quality and sustainability of the world's food supply.

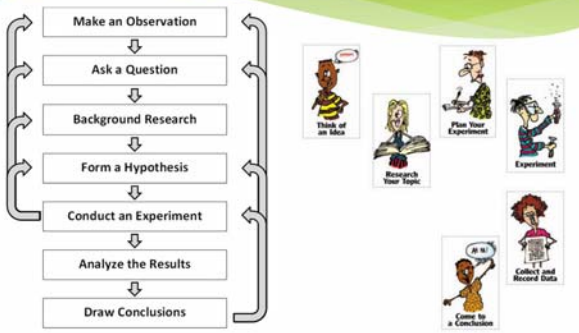
Definition

Types of Research

- Quantitative
  - Data includes measurements or counts
  - Standard scales
- Qualitative
  - Descriptions

Quantitative Examples- temperature in Fahrenheit,
Qualitative Examples- color, emotions, descriptions of the environment

Steps of the Scientific Method



Remind students that this method does not have to be performed in a straight line- students can return to earlier steps if necessary.
This can be seen in How to Train your Dragon when Hiccup tests a new method to help Toothless fly when the previous is not effective.

Images: http://jpostema.napsk12.org/scientific-method-1

Definition

Types of Variables

- **Independent Variables**
  - Altered or manipulated for the experiment
- **Dependent Variables**
  - Respond during the experiment
- **Constants**
  - Factors that are not changed during the experiment

What is a variable?
Definition: Variable-"things or factors that can be assigned or take on different values in an experiment"

Definition

Making your Experiment Valid

- **Control Group**
  - Group Unchanged by researcher
  - Measure the influence of unanticipated
- **Multiple Trials**

-Multiple trials are necessary- a trial consists on a single organism or object (one pot) with a specific treatment applied to it- multiple trials are necessary for each treatment

Image: http://evidencebasedliving.human.cornell.edu/2011/04/randomized-controlled-designs-the-gold-standard-for-knowing-what-works-2/

Definition

Hypothesis

- Prediction of the relationship between a independent and dependent variable in an experiment
- Must use background research to form hypothesis
- Accept or Reject after analyzing results

Definition: "a prediction of the relationship of an independent and dependent variable to be tested in an experiment; it predicts the effect that changes purposely made in the independent variable will have on the dependent variable" (Students and Research)

-hypothesis can be non-directional

-_____ will **differ** under _____ conditions from _____ conditions.

~or~

-_____ and _____ will have different _____.

Image: http://pascencio.cos.ucf.edu/methods%20presentation.html

Forms of Hypotheses

- If-Then
- Non-directional

-If-Then Hypothesis- predicts an outcome

-Non-Directional- difference or no difference

-If-Then hypothesis (more common)

-"If *independent variable* is related to *dependent variable*, then *predict the effect*."

~or~

-"If the *independent variable* is *describe the changes, then the* dependent variable will *predict the effect*."

(STEM Student Research Handbook)

-Non-directional Hypothesis

-_____ will **differ** under _____ conditions from _____ conditions.

~or~

-_____ and _____ will have different _____.

Examples from Students and Research:

Directional Research Hypothesis-

-"Wood production in trees adjacent to herbicide-treated fields will be less than wood production in trees adjacent to non-herbicide treated fields"

Non-Directional Research-

-"Wood production in trees adjacent to herbicide treated fields will differ from wood production in trees adjacent to non-herbicide treated fields"

Hypothesis Example

Non-Directional

* The growth rate of a plant will differ under green light.

Directional

* If a plant is exposed to is green light, then the growth rate will increase.

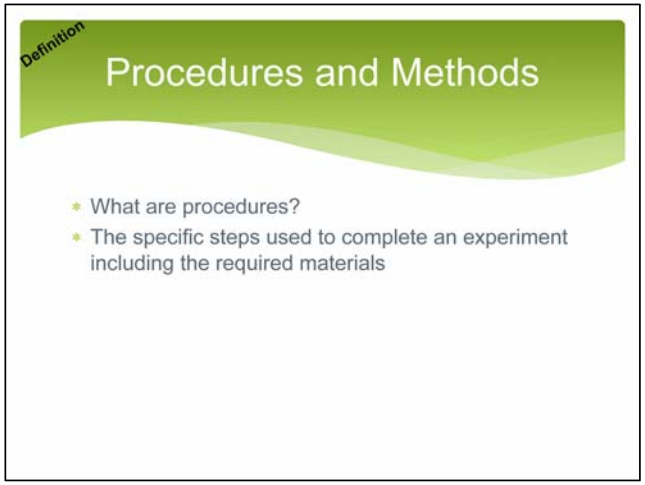
Hypothesis Example

Non-Directional

* Rate of gain in cattle fed corn will differ from cattle fed grass.

Directional

* If cattle are fed corn then the rate of gain will be greater than cattle fed grass.



-Ask students “What a procedure is?” before giving definition.
Definition: The specific steps used to complete an experiment including the required materials.
Procedures Activity
Why are they important?