

Scientific Investigation: The Nature of Science Learning Activity

Thinking like a Scientist

Overview: Understanding the nature of science is a vital part of becoming a scientist. Students can memorize the steps in the scientific method and still not comprehend the intricacies of scientific reasoning to prove or disprove a hypothesis. Some hypotheses require more observation than experimentation. Often hypotheses will be tested by other scientists.

The nature of science and attaining the scientific mind takes time over the course of the school year and can be incorporated into various labs, experiments and observations about any scientific topic.

The Nature of Science is based on these six principles:

1. The Natural World is Understandable
2. Science is based on evidence – both observational and experimental
3. Science is a blend of logic and innovation
4. Scientific ideas are durable yet subjective to change as new data are collected
5. Science is a complex social endeavor
6. Scientists try to remain objective and engage in peer review to help avoid bias

The Scientific Method of Investigation

1. Question
2. Hypothesis
3. Procedure – conduct the experiment
4. Collect Data
5. Analyze Data
6. Conclusion

Procedure: Using various apple types (Granny Smith, Macintosh, Fuji, etc.) teach the nature of science through evidence collection and observation of apples. Most students will be familiar with the standard apple types so feel free to purchase ones that they may not have seen or eaten. The purpose of this activity is to teach the power of evidence

collection and observation in a student's quest to think both logically and creatively like a real scientist.

Have the students ask a question such as, "Do apples come in different shapes and sizes?" Or "Do apples come in one color and/or size?"

Have the students write a hypothesis such as, "Apples come in different shapes and sizes." Or "Apples come in one shape and size." Or "Apples are only one color." The students can then agree or disagree with the hypothesis.

Now the students are ready for the observation portion of the activity. Place various apple varieties on a table at the front of the class. The students are not to be permitted to touch the apples, but merely observe.

Have the students write down, call out, or select all observations on the lab sheet provided. Some observations could be shiny, red, green, wide, short, with a stem, without a stem, etc.

ASOL:

5S-SI 1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which

- a) distinctions are made among observations, conclusions, inferences, and predictions;
- b) objects or events are classified and arranged according to characteristics or properties;
- e) predictions and inferences are made, and conclusions are drawn based on data from a variety of sources;

5S-SI 2 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which

- d) hypotheses are formed from testable questions;

8S-SI 1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations which

a) observations are made involving fine discrimination between similar objects and organisms;

8S-SI 2 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which

b) a classification system is developed based on multiple attributes;

8S-SI 3 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which

k) research methods are used to investigate practical problems and questions;

HSS-SI 2-The student will demonstrate an understanding of the nature of science and scientific reasoning and logic. Key concepts include

b) Evidence is required to evaluate hypotheses and explanations

c) Observation and logic are essential for reaching a conclusion

Materials Needed:

- A variety of different colored apples of various types and sizes
- A table to display the apples on
- Lab activity sheet
- Tape measure
- Scale
- Colored pencils
- Glue
- scissors

Instructional Setting: This activity can be done within the classroom environment.

Community Connections and/or Peer Interactions:

- Ask students to ask their family to provide an apple for this activity.
- Prior to the activity, plan a CBI trip to a grocery store and have students buy a wide variety of apples. After the activity have students take turns sharing one surprising thing they learned.

Functional Activity/Routine:

- Students could eat the apples raw, make a fruit salad or cook the apples.
- Use recipes to create dishes made from apples creating a classroom recipe book to be added to the classroom library.
- Safety lesson on washing fruits and vegetables before eating them.
- Plan a bag lunch menu for lunch that could include an apple or apple product.

Strategies to Collect Evidence: Specific Options for Differentiating this Activity:

- Use picture symbols to assist non-reading students. Use assistive technology where needed. This could include programming a voice output device with pictures of the different apples,
- Use peer assisted reading of steps.
- Take pictures of the various apples and have students cut and paste to create a grocery list of items to purchase at the store.
- Students can illustrate the apples using colored pencils.

Extension Ideas:

The students might also estimate the mass and width of the various apples or predict the taste of each apple. They can state which apple they might enjoy in their lunch box and why.

Students could weigh and measure the apples and compare to the estimates that they made. Students could form a new hypotheses such as, “When an apple is cut it will turn brown.” Or “When cut apples are placed in lemon juice they will not turn brown.” These extensions will require more student observation and the use of variables within a simple experiment.

Other fruits and vegetables can be used rather than apples. Students for instance may be less familiar with different types and colors of carrots or squash.

References: 2010 Science Standards of Learning – Aligned Standards of Learning Curriculum Framework for High School

Name: _____ Date: _____

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Thinking like a Scientist – Apple Experiment

Lab sheet

 Question:



Hypothesis:





Procedure:

- The teacher will set up several apples on a table in front of the classroom
- Stay seated and quietly observe (look-at) the apples
- Please do not touch the apples.
- Write down anything you observe.




Data:



<p>Apple Type</p> 	<p>Observation</p> 



Data Continued:

Apple Type 	Estimate Mass	Actual Mass	Estimate Width	Actual Width



Analysis:

1. How many apples were the same shape and size?

2. How many apples were different shapes and sizes?

3. How many apples were the same colors?

4. Where are apples grown?

5. Are apples natural or man-made?

6. Ask your classmates how they described the apples? How is that the same or different from the way you described the apples.

7. What did you learn from this activity?



8. Do you have another question about apples?



9. What would your new hypothesis be?












Conclusion:








My Hypothesis was correct/incorrect?

HSS-SI 2 – The student will demonstrate an understanding of the nature of science and scientific reasoning and logic. Key concepts include:

- B) Evidence is required to evaluate hypothesis and explanations
- C) Observations and logic are essential for reaching a conclusion.

Cut and paste pieces

Images for Apple Experiment

1. <https://colorado.doortodoororganics.com/shop/products/apples-granny-smith> ----- image of granny smith apple.
2. <http://www.bbc.com/news/magazine-24578762> -----the Pink Lady Apple
3. http://www.hudsonproduce.com/fresh-produce/apples_Fuji.html -
-----fuji apple photo.
4. <http://www.theappleacres.com/our-apples/mcintosh-apples> ----
McIntosh Apple photo
5. http://www.hearthealthyonline.com/cholesterol/lower-cholesterol/apples-power-foods_ss3.html ----image for types of apples
6. <http://www.nyapplecountry.com/goldenphoto.htm> ----- golden delicious apple photo
7. <http://www.mrjacksfarm.com/dnn/FruitNutTrees/AppleTrees/RedDelicious/tabid/111/Default.aspx> ----- red delicious photo
8. <http://lookatmyapples.tumblr.com/> ----- photo of a rome apple
9. <http://rentanappletree.com/proddetail.php?prod=Empire> ----
Empire Apple