

Do You See What I See?

OVERVIEW:

In this activity, students will apply one of the basic skills in science – observation. Students will analyze dollar bills and determine whether or not the money is real or counterfeit.

CONCEPTS:

National Science Education Standards:

Standard A: Science as Inquiry (Abilities Necessary to do Scientific Inquiry)

- Ask questions that can be answered through scientific investigations.
- Design and conduct scientific investigation.
- Develop descriptions, explanations, predictions, and models using evidence.
- Communicate scientific procedures and explanations.
- Think critically and logically to develop the relationship between evidence and explanation.
- Values and practice skepticism, questioning, evaluation, and suggesting alternatives in making scientific advances.

Benchmark 1: The Scientific World View

B: Scientific Inquiry

- What people expect to observe often affects what they actually do observe. Strong beliefs about what should happen in particular circumstances can prevent them from detecting other results. Scientists know about this danger to objectivity and take steps to try to avoid it when designing investigations and examining data. One safeguard is to have different investigators conduct independent studies of the same question.

C: Scientific Enterprise

- Colleges and universities, businesses, industries, hospitals, and many government agencies employ scientists. Their place of work includes offices, classrooms, laboratories, farms, factories, and natural field settings ranging from space to the ocean floor.

OBJECTIVES:

Student will:

- Recognize that making observations involves using all of your senses and is an important aspect of conducting research.
- Compare and contrast real and counterfeit money

PROCEDURES:

- Allow one hour to complete the activity.
- Share background information.
- Do the Activity (Part A). “The Scene of the Crime”
- Follow up the activity with the discussion questions (see Part B). These questions can be used for assessment purposes.

MATERIALS:

- Magnifying glass
- One dollar bill
- One five dollar bill printed since 1990 (see front of bill to lower right of portrait)
- One “fake” five dollar bill (front only)

BACKGROUND:

When you think of the term scientist, what picture comes to mind? Is it a person in a white lab coat, holding a clipboard, no social life, mad hair, and with some possible evil genius tendencies? Well think again. Every one of us – whether a poet, janitor, nuclear physicist – has to be able to think scientifically, and to understand some science, to get through with our lives.

Science is used by each of us in our everyday lives to help us make decisions not based by emotions and feelings, but based upon evidence. Take for example here in Lexington recently; there was a smoking ban that was put in effect. This was not just a random decision that someone concocted one night and the following morning was implemented. It took a long time to come up with the research findings that showed non-smokers, when exposed to second hand smoke can suffer a number of diseases. When we think about what to eat, whether or not to smoke, whether to drive or run; these are all decisions that hinge on science.

Science is fun and can lead to very many interesting careers. Take for example Catherine MacDonald. From an early age, she was interested in designing and making things, and in sports. She went on to study engineering at the University and she is now an engineer with the Formula 1 giant, Jordan.

People with science qualifications go on to work in the music industry, in art restoration, in marine biology, in sports science, in special effects in the film industry, in astronomy, in aeronautics, in telecommunications, in food technology, and many other areas.

The scientist does not study nature because it is useful; he studies it because he delights in it, and he delights in it because it is beautiful. If nature were not beautiful, it would not be worth knowing, and if nature were not worth knowing, life would not be worth living. – Henri Poincare’

One thing to note is that scientists are not always good communicators but the information they give is good and essential to our health and well-being. Therefore, it is important to read and find out as much as we can about science and how they affect each of us, and what we can do to help.

Times are changing and along with it, our economy is changing too. In the last few centuries, we as a people have gone through different economies; 1792 Frontier Economy; 1830 Agricultural Economy; 1910 Energy and Industrial Economy; 1980 Digital Economy; and as of 2000 we are and have been going through the New Economy.

In the New Economy, technology is revolutionizing how and where we do business. We sell and compete in a worldwide marketplace. 21st Century Americans are working with their brains, not their hands. Wealth is created by applying innovative ideas and technologies to services, products, and manufacturing processes.

The new economy is now focusing on people coming up with new, very original and creative ideas. It is requiring people to think about the future and what they can do right now to make things easier and efficient.

The challenge now is for young people to discover the fun in science and technology and come up with their own ideas that will work for everyone in the future. Observation involves using your senses to gather information about an object. It is a description of what is actually perceived

Additional notes taken from:

<http://www.he.courses-careers.com/science.htm>

<http://www.people.virginia.edu/~rjh9u/studysci/html>

Kentucky's New Economy, *Bright Science, Bright Future*; Published by The Lane Report, Office for the New Economy, Nov. 2003.

ACTIVITY:

Part A: Real or Counterfeit

Counterfeit currency often makes big headlines in the newspaper--- counterfeiting rings are broken up, counterfeit money is discovered being “passed” at the local bank or grocery store. How can the “experts” tell the difference between real and fake? Use some science and some sleuthing to learn how!

The Scene of the Crime

Here is a scenario: Imagine that you are a brand new Secret Service Agent and your first assignment is to examine a pile of money confiscated during a raid to determine if it is real or counterfeit. How would you approach this problem? You know that the Treasury Department of the Federal government is responsible for printing currency, and that they have many “secret” anti-counterfeiting features incorporated into currency. You realize that you can use a magnifying glass to discover some of these “secrets” and succeed in your important (but fictional) assignment.

1. Run your fingertip along the empty part of the dollar bill and compare the feel to that of the highly doodled area by the “1” in the corner. Do they feel the same or different? What color are the clear areas of the bill?
2. With the magnifying glass, examine the clear areas of the \$1 bill. Move the bill around. What color does it look like? What else do you see in the clear area?

3. Compare the front of the real and fake five-dollar bills with your eyes alone. Can you tell which is which? Examine the lines around Lincoln's face and eyes alone. Now compare to the same area of the "fake" bill --- is there a difference?
4. Look in the clear area to the left of the Federal Reserve Seal (which is to the left of Lincoln's portrait). What do you see? Can you make out any writing? Look for this on the "fake" bill – Is it there?
5. Without using the magnifier, examine the rime around Lincoln's portrait. Is it a solid line? Now use the magnifier. Do you see anything different? Check your "fake" bill for this feature.
6. What other features do you see that can distinguish authentic bills from "fakes"?

True scientific reasoning applies to many areas of life. The ability to observe, hypothesize, test, and make conclusions based on evidence is a critical skill in an age where the truth can be hard to find!

Part B:

Ask the following questions and allow time for discussion.

Share:

Are there tools a scientist can use to aid in making observations? What are they and how are they used?

Process:

How do you decide what information is important?

Generalize:

How do keep track of information or observations made during a procedure?

Apply:

Why is doing research before hand important in conducting an investigation?