

RAFT IDEAS

Topics: Scientific Method, Logic, Data Collection & Analysis

Materials List

- ✓ VHS tape cases or small, sturdy cardboard boxes
- ✓ Various common objects (e.g. – marbles, dice, beans, rubber balls)
- ✓ Cardboard pieces
- ✓ Hot glue
- ✓ Duct tape and/or black masking tape

This activity can be used to support the teaching of: Science Investigation and Experimentation, Grades 4 & above. Particularly useful when applied to:

Next Generation Science Standards:

- Structure of matter (Grade 5, Physical Science 1-1; Middle School, Physical Science 1-1)
- Property of materials (Grade 5, Physical Science 1-3)
- Science & Engineering Practices (Grades 4-12)



Black Box

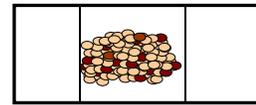
What's Inside? Hard to be 100% Sure



Students shake, rattle, and roll these “Black Boxes” to try to determine the insides... but no peeking. Ever!!

Assembly

Use common objects (marbles, beans, dice) and hot-glued cardboard pieces to make the insides of the Black Box models. Make at least 4 models. Cover each model entirely with duct tape or masking. Keep the insides simple. Suggestions.



To Do and Notice

1. Students take turns twisting, turning, tumbling, and shaking the boxes to try and determine the materials and structure inside each. Violent shaking and opening the boxes are not allowed.
2. After investigations, students write down their observations and suggest a possible internal structure of each Black Box.
3. Next, students model scientist peer review. In groups of 4-8, students discuss their suggestions and decide as a team on the most plausible internal structure of each box.
4. Teams should present their theories to the whole class or to the teacher. Presentations should include:
 - a. How sure is the team of their suggestion for each box? (50%, 90%)
 - b. What other tests would they like to run to find out more? (X-ray machine, metal detector, probes)

*Note: At this point, most students will request to open the boxes to see if their suggestions were correct. Students should NOT be allowed to open the boxes!

The Science Behind the Activity

The term “black box” refers to any object that has hidden inner workings. Investigators can explore behavior, but cannot determine exact details of the objects’ interiors. In the science game, narrowing the possibilities and agreeing on the best explanation is what it is all about. Having an “answer” is relative, given available data, tools, and techniques. When students model peer review (an important step in the scientific process often omitted from textbooks), they discuss observations and collectively determine the best explanation. They model the process used to understand actual “black boxes” in science, such as an atom or planet Earth. We cannot literally slice the Earth in half to see if we are correct about its internal structure.

Web Resources (Visit www.raft.net/raft-idea?isid=306 for more resources!)

Black box philosophy: <http://www.dctech.com/eureka/short-stories/cat.php>

Scientific method: http://www.sciencemadesimple.com/scientific_method.html & <http://scijinks.jpl.nasa.gov/scientific-method/>